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T A B L E S

Requisite to be used with the

ASTRONOMICAL AND NAUTICAL

E P H E M E R I S.

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A TABLE of the Refraction of the Heavenly Bodies
in Altitude.

App. Alt.	Refrac.	App. Alt.	Refrac.	App. Alt.	Refr.	App. Alt.	Refr.	App. Alt.	Refr.
°	'	°	'	°	'	°	'	°	'
0. 0	33. 0	4. 50	10. 11	10. 30	5. 0	26. 0	1. 56	59. 0	0. 34
5	32. 10	5. 0	9. 54	10. 45	4. 53	27. 1	1. 51	60. 0	33
10	31. 22	5. 10	9. 35	11. 0	4. 47	28. 1	1. 47	61. 0	32
15	30. 35	5. 20	9. 23	11. 15	4. 40	29. 1	1. 42	62. 0	30
20	29. 50	5. 30	9. 8	11. 30	4. 34	30. 1	1. 38	63. 0	29
30	28. 22	5. 40	8. 54	11. 45	4. 29	31. 1	1. 35	64. 0	28
32	28. 5	5. 50	8. 41	12. 0	4. 23	32. 1	1. 31	65. 0	26
36	27. 30	6. 0	8. 28	12. 20	4. 16	33. 1	1. 28	66. 0	25
40	27. 0	6. 10	8. 15	12. 40	4. 9	34. 1	1. 24	67. 0	24
50	25. 42	6. 20	8. 3	13. 0	4. 3	35. 1	1. 21	68. 0	23
1. 0	24. 29	6. 30	7. 51	13. 20	3. 57	36. 1	1. 18	69. 0	22
1. 10	23. 20	6. 40	7. 40	13. 40	3. 51	37. 1	1. 16	70. 0	21
1. 20	22. 15	6. 50	7. 30	14. 0	3. 45	38. 1	1. 13	71. 0	19
1. 30	21. 15	7. 0	7. 20	14. 20	3. 40	39. 1	1. 10	72. 0	18
1. 40	20. 18	7. 10	7. 11	14. 40	3. 35	40. 1	1. 8	73. 0	17
1. 50	19. 25	7. 20	7. 2	15. 0	3. 30	41. 1	1. 5	74. 0	16
2. 0	18. 35	7. 30	6. 53	15. 30	3. 24	42. 1	1. 3	75. 0	15
2. 10	17. 48	7. 40	6. 45	16. 0	3. 17	43. 1	1. 1	76. 0	14
2. 20	17. 4	7. 50	6. 37	16. 30	3. 10	44. 1	59	77. 0	13
2. 30	16. 24	8. 0	6. 29	17. 0	3. 4	45. 1	57	78. 0	12
2. 40	15. 45	8. 10	6. 22	17. 30	2. 59	46. 1	55	79. 0	11
2. 50	15. 0	8. 20	6. 15	18. 0	2. 54	47. 1	53	80. 0	10
3. 0	14. 36	8. 30	6. 8	18. 30	2. 49	48. 1	51	81. 0	9
3. 10	14. 4	8. 40	6. 1	19. 0	2. 44	49. 1	49	82. 0	8
3. 20	13. 34	8. 50	5. 55	19. 30	2. 39	50. 1	48	83. 0	7
3. 30	13. 6	9. 0	5. 48	20. 0	2. 35	51. 1	46	84. 0	6
3. 40	12. 40	9. 10	5. 42	20. 30	2. 31	52. 1	44	85. 0	5
3. 50	12. 15	9. 20	5. 36	21. 0	2. 27	53. 1	43	86. 0	4
4. 0	11. 51	9. 30	5. 31	21. 30	2. 24	54. 1	41	87. 0	3
4. 10	11. 20	9. 40	5. 25	22. 0	2. 20	55. 1	40	88. 0	2
4. 20	11. 8	9. 50	5. 20	23. 0	2. 14	56. 1	38	89. 0	1
4. 30	10. 48	10. 0	5. 15	24. 0	2. 7	57. 1	37	90. 0	0
4. 40	10. 29	10. 15	5. 7	25. 0	2. 2	58. 1	35		

A TABLE of the Moon's Parallax in Altitude.

App. Alt. of D	Horizontal Parallax of the Moon.									
	°	53'	54'	55'	56'	57'	58'	59'	60'	61'
1		53'	54'	55'	56'	57'	58'	59'	60'	61'
2		53	54	55	56	57	58	59	60	61
3		53	54	55	56	57	58	59	60	61
4		53	54	55	56	57	58	59	60	61
5		53	54	55	56	57	58	59	60	61
6		53	54	55	56	57	58	59	60	61
7		53	54	55	56	57	58	59	60	61
8		52	53	54	55	56	57	58	59	60
9		52	53	54	55	56	57	58	59	60
10		52	53	54	55	56	57	58	59	60
11		52	53	54	55	56	57	58	59	60
12		52	53	54	55	56	57	58	59	60
13		52	53	54	55	56	57	58	59	60
14		51	52	53	54	55	56	57	58	59
15		51	52	53	54	55	56	57	58	59
16		51	52	53	54	55	56	57	58	59
17		51	52	53	54	55	56	57	58	59
18		50	51	52	53	54	55	56	57	58
19		50	51	52	53	54	55	56	57	58
20		50	51	52	53	54	55	56	57	58
21		49	50	51	52	53	54	55	56	57
22		49	50	51	52	53	54	55	56	57
23		49	50	51	52	53	54	55	56	57
24		48	49	50	51	52	53	54	55	56
25		48	49	50	51	52	53	54	55	56
26		47	48	49	50	51	52	53	54	55
27		47	48	49	50	51	52	53	54	55
28		47	48	49	50	51	52	53	54	55
29		46	47	48	49	50	51	52	53	54
30		46	47	48	49	50	51	52	53	54

Continuation of the TABLE of the Moon's Parallax in
Altitude.

App. Alt. of ☾	Horizontal Parallax of the Moon.									
°	53'	54'	55'	56'	57'	58'	59'	60'	61'	62'
31	45'	45'	47'	48'	49'	50'	51'	51'	52'	53'
32	45	46	47	47	48	49	50	51	52	53
33	44	45	46	47	48	49	49	50	51	52
34	44	45	46	46	47	48	49	50	51	52
35	43	44	45	46	47	47	48	49	50	51
36	43	44	44	45	46	47	48	48	49	50
37	42	43	44	45	45	46	47	48	49	50
38	42	43	43	44	45	46	46	47	48	49
39	41	42	43	43	44	45	46	47	47	48
40	40	41	42	43	44	44	45	46	47	48
41	40	41	41	42	43	44	44	45	46	47
42	39	40	41	42	42	43	44	45	45	46
43	38	39	40	41	42	42	43	44	45	46
44	38	39	40	40	41	42	42	43	44	45
45	37	38	39	40	40	41	42	43	43	44
46	36	37	38	39	40	40	41	42	42	43
47	36	37	38	38	39	40	40	41	42	43
48	35	36	37	37	38	39	39	40	41	42
49	34	35	36	37	37	38	39	39	40	41
50	34	35	35	36	37	37	38	39	39	40
51	33	34	35	35	36	36	37	38	38	39
52	32	33	34	34	35	36	36	37	38	39
53	31	32	33	34	34	35	35	36	37	38
54	31	32	32	33	33	34	35	35	36	37
55	30	31	31	32	33	33	34	34	35	36
56	29	30	31	31	32	32	33	34	34	35
57	28	29	30	30	31	32	32	33	33	34
58	28	29	29	30	30	31	31	32	32	33
59	27	28	28	29	29	30	30	31	31	32
60	26	27	27	28	28	29	29	30	30	31

A. TABLE to turn Degrees and Minutes into Time, and the contrary.

D.	H.M.	D.	H.M.	D.	H.M.	D.	H.M.
M.	M. S.	M.	M. S.				
1	0. 4	31	2. 4	61	4. 4	91	6. 4
2	0. 8	32	2. 8	62	4. 8	92	6. 8
3	0. 12	33	2. 12	63	4. 12	93	6. 12
4	0. 16	34	2. 16	64	4. 16	94	6. 16
5	0. 20	35	2. 20	65	4. 20	95	6. 20
6	0. 24	36	2. 24	66	4. 24	96	6. 24
7	0. 28	37	2. 28	67	4. 28	97	6. 28
8	0. 32	38	2. 32	68	4. 32	98	6. 32
9	0. 36	39	2. 36	69	4. 36	99	6. 36
10	0. 40	40	2. 40	70	4. 40	100	6. 40
11	0. 44	41	2. 44	71	4. 44	101	6. 44
12	0. 48	42	2. 48	72	4. 48	102	6. 48
13	0. 52	43	2. 52	73	4. 52	103	6. 52
14	0. 56	44	2. 56	74	4. 56	104	6. 56
15	1. 0	45	3. 0	75	5. 0	105	7. 0
16	1. 4	46	3. 4	76	5. 4	106	7. 4
17	1. 8	47	3. 8	77	5. 8	107	7. 8
18	1. 12	48	3. 12	78	5. 12	108	7. 12
19	1. 16	49	3. 16	79	5. 16	109	7. 16
20	1. 20	50	3. 20	80	5. 20	110	7. 20
21	1. 24	51	3. 24	81	5. 24	111	7. 24
22	1. 28	52	3. 28	82	5. 28	112	7. 28
23	1. 32	53	3. 32	83	5. 32	113	7. 32
24	1. 36	54	3. 36	84	5. 36	114	7. 36
25	1. 40	55	3. 40	85	5. 40	115	7. 40
26	1. 44	56	3. 44	86	5. 44	116	7. 44
27	1. 48	57	3. 48	87	5. 48	117	7. 48
28	1. 52	58	3. 52	88	5. 52	118	7. 52
29	1. 56	59	3. 56	89	5. 56	119	7. 56
30	2. 0	60	4. 0	90	6. 0	120	8. 0

Continuation of the TABLE for turning Degrees and Minutes into Time, and the contrary.

D.	H. M.	D.	H. M.	D.	H. M.	D.	H. M.
121	8. 4	151	10. 4	181	12. 4	211	14. 4
122	8. 8	152	10. 8	182	12. 8	212	14. 8
123	8. 12	153	10. 12	183	12. 12	213	14. 12
124	8. 16	154	10. 16	184	12. 16	214	14. 16
125	8. 20	155	10. 20	185	12. 20	215	14. 20
126	8. 24	156	10. 24	186	12. 24	216	14. 24
127	8. 28	157	10. 28	187	12. 28	217	14. 28
128	8. 32	158	10. 32	188	12. 32	218	14. 32
129	8. 36	159	10. 36	189	12. 36	219	14. 36
130	8. 40	160	10. 40	190	12. 40	220	14. 40
131	8. 44	161	10. 44	191	12. 44	221	14. 44
132	8. 48	162	10. 48	192	12. 48	222	14. 48
133	8. 52	163	10. 52	193	12. 52	223	14. 52
134	8. 56	164	10. 56	194	12. 56	224	14. 56
135	9. 0	165	11. 0	195	13. 0	225	15. 0
136	9. 4	166	11. 4	196	13. 4	226	15. 4
137	9. 8	167	11. 8	197	13. 8	227	15. 8
138	9. 12	168	11. 12	198	13. 12	228	15. 12
139	9. 16	169	11. 16	199	13. 16	229	15. 16
140	9. 20	170	11. 20	200	13. 20	230	15. 20
141	9. 24	171	11. 24	201	13. 24	231	15. 24
142	9. 28	172	11. 28	202	13. 28	232	15. 28
143	9. 32	173	11. 32	203	13. 32	233	15. 32
144	9. 36	174	11. 36	204	13. 36	234	15. 36
145	9. 40	175	11. 40	205	13. 40	235	15. 40
146	9. 44	176	11. 44	206	13. 44	236	15. 44
147	9. 48	177	11. 48	207	13. 48	237	15. 48
148	9. 52	178	11. 52	208	13. 52	238	15. 52
149	9. 56	179	11. 56	209	13. 56	239	15. 56
150	10. 0	180	12. 0	210	14. 0	240	16. 0

Continuation of the TABLE for turning Degrees and Minutes into Time; and the contrary.

D.	H. M.	D.	H. M.	D.	H. M.	D.	H. M.
241	16. 4	271	18. 4	301	20. 4	331	22. 4
242	16. 8	272	18. 8	302	20. 8	332	22. 8
243	16. 12	273	18. 12	303	20. 12	333	22. 12
244	16. 16	274	18. 16	304	20. 16	334	22. 16
245	16. 20	275	18. 20	305	20. 20	335	22. 20
246	16. 24	276	18. 24	306	20. 24	336	22. 24
247	16. 28	277	18. 28	307	20. 28	337	22. 28
248	16. 32	278	18. 32	308	20. 32	338	22. 32
249	16. 36	279	18. 36	309	20. 36	339	22. 36
250	16. 40	280	18. 40	310	20. 40	340	22. 40
251	16. 44	281	18. 44	311	20. 44	341	22. 44
252	16. 48	282	18. 48	312	20. 48	342	22. 48
253	16. 52	283	18. 52	313	20. 52	343	22. 52
254	16. 56	284	18. 56	314	20. 56	344	22. 56
255	17. 0	285	19. 0	315	21. 0	345	23. 0
256	17. 4	286	19. 4	316	21. 4	346	23. 4
257	17. 8	287	19. 8	317	21. 8	347	23. 8
258	17. 12	288	19. 12	318	21. 12	348	23. 12
259	17. 16	289	19. 16	319	21. 16	349	23. 16
260	17. 20	290	19. 20	320	21. 20	350	23. 20
261	17. 24	291	19. 24	321	21. 24	351	23. 24
262	17. 28	292	19. 28	322	21. 28	352	23. 28
263	17. 32	293	19. 32	323	21. 32	353	23. 32
264	17. 36	294	19. 36	324	21. 36	354	23. 36
265	17. 40	295	19. 40	325	21. 40	355	23. 40
266	17. 44	296	19. 44	326	21. 44	356	23. 44
267	17. 48	297	19. 48	327	21. 48	357	23. 48
268	17. 52	298	19. 52	328	21. 52	358	23. 52
269	17. 56	299	19. 56	329	21. 56	359	23. 56
270	18. 0	300	20. 0	330	22. 0	360	24. 0

A CORRECT TABLE

OF THE

Longitude and Latitude of the principal Zodiacal Stars proper to take the Moon's Distance from, for finding the Longitude at Sea.

Deduced from Dr. Bradley's Observations.

Beginning of 1767.	Mag- nitud.	Longitude.	Latitude.
		S. ° ' "	° ' "
γ Pegasi ———	2	0. 5. 54. 38	12. 35. 35 N
* α Arietis ———	2	1. 4. 24. 20	9. 57. 30 N
α Ceti ———	2	1. 11. 3. 56	12. 36. 16 S
* Aldebaran ———	1	2. 6. 32. 3	5. 29. 2 S
β Tauri ———	2	2. 19. 19. 19	5. 21. 59 N
α Orionis ———	1	2. 25. 30. 5	16. 3. 31 S
* Pollux ———	1. 2	3. 20. 0. 16	6. 40. 5 N
Procyon ———	1	3. 22. 34. 29	15. 58. 8 S
* Regulus ———	1	4. 26. 35. 31	0. 27. 27 N
β Leonis ———	2	5. 18. 23. 9	12. 17. 8 N
* Spica Virginis ———	1	6. 20. 35. 31	2. 2. 11 S
α Libræ ———	2	7. 11. 50. 11	0. 21. 48 N
β Libræ ———	2	7. 16. 7. 23	8. 31. 32 N
* Antares ———	1	8. 6. 30. 40	4. 32. 17 S
σ Sagittarii ———	2. 3	9. 9. 7. 59	3. 24. 55 S
* α Aquilæ ———	1	9. 28. 29. 13	29. 18. 36 N
* β Capricorni ———	3	10. 0. 47. 37	4. 36. 46 N
* Fomalhaut ———	1	11. 0. 34. 47	21. 6. 28 S
* α Pegasi ———	2	11. 20. 14. 30	19. 24. 38 N

N. B. Those Stars only marked with Asterisks are made use of in the Distances of the Astronomical and Nautical Ephemeris.

TABLE to find the Aberration of a Zodiacal Star in Longitude.

Aberration * in Longitude.				
Arg. Long. ☉ — Long. *				
Sign.	0	1	2	
	—	—	—	
Sig.	6	7	8	
	+	+	+	
0	//	//	//	0
0	20	17	10	30
3	20	17	9	27
6	20	16	8	24
9	20	16	7	21
12	20	15	6	18
15	19	14	5	15
18	19	13	4	12
21	19	13	3	9
24	18	12	2	6
27	18	11	1	3
30	17	10	0	0
Sig.	11	10	9	
	—	—	—	
Sig.	5	4	3	
	+	+	+	

A particular Table of Limits for α Aquilæ.

Lat. N.	Dif. of Lon. ☉ & α Aquilæ	Lat. S.	Dif. of Lon. ☉ & α Aquilæ
0	0 /	0	0 /
0	48. 26	0	48. 26
1	47. 15	1	49. 45
2	45. 43	2	51. 3
3	44. 11	3	52. 10
4	42. 43	4	53. 21
5	41. 10	5	54. 26
0. 20	40. 38	0. 20	54. 46

A TABLE for choosing proper Stars for observing the Moon's Diff. from.

Dif. of Sum of ☉ & * Lats.	Dif. of Lon. of ☉ & *.
0	0 /
1	10. 0
2	10.
3	10.
4	10.
5	10.
6	10. 57
7	12. 49
8	14. 42
9	16. 37
10	18. 34
11	20. 33
12	22. 35
13	24. 39
14	26. 46
15	28. 57
16	31. 12
17	33. 31
18	35. 56
19	38. 28
20	41. 6
21	43. 54
22	46. 52
23	50. 3
24	53. 32
25	57. 23
26	61. 49
27	65. 58
28	73. 48

A TABLE for finding the Correction of the Moon's Longitude or Latitude, obtained by Proportion from the Place; calculated for Noon and Midnight.

App. Time after Noon or Mid- night.	Second Difference of Moon's Place.										App. Time after Noon or Mid- night.
	1'	2'	3'	4'	5'	6'	7'	8'	9'	10'	
H. M.	"	"	"	"	"	"	"	"	"	"	H. M.
0. 0	0	0	0	0	0	0	0	0	0	0	12. 0
0. 10	0	1	1	2	2	2	3	3	4	4	11. 50
0. 20	1	2	2	3	4	5	6	6	7	8	11. 40
0. 30	1	2	4	5	6	7	8	10	11	12	11. 30
0. 40	2	3	5	6	8	9	11	13	14	16	11. 20
0. 50	2	4	6	8	10	12	13	15	17	19	11. 10
1. 0	2	5	7	9	11	14	16	18	21	23	11. 0
1. 10	3	5	8	10	13	16	18	21	24	26	10. 50
1. 20	3	6	9	12	15	18	21	24	27	30	10. 40
1. 30	3	6	10	13	16	20	23	26	29	33	10. 30
1. 40	4	7	11	14	18	21	25	29	32	36	10. 20
1. 50	4	8	12	15	19	23	27	31	35	39	10. 10
2. 0	4	8	12	17	21	25	29	33	37	42	10. 0
2. 10	4	9	13	18	22	27	31	35	40	44	9. 50
2. 20	5	9	14	19	23	28	33	38	42	47	9. 40
2. 30	5	10	15	20	25	30	34	39	44	49	9. 30
2. 40	5	10	15	21	26	31	36	41	47	52	9. 20
2. 50	5	11	16	22	27	32	38	43	49	54	9. 10
3. 0	6	11	17	23	28	34	39	45	51	56	9. 0
3. 10	6	12	17	23	29	35	41	46	52	58	8. 50
3. 20	6	12	18	24	30	36	42	48	54	60	8. 40
3. 30	6	12	18	25	31	37	43	49	56	62	8. 30
3. 40	6	13	19	25	32	38	45	51	57	64	8. 20
3. 50	6	13	19	26	33	39	46	52	59	65	8. 10
4. 0	7	13	20	27	33	40	47	53	60	67	8. 0
4. 10	7	14	20	27	34	41	47	54	61	68	7. 50
4. 20	7	14	21	28	35	41	48	55	62	69	7. 40
4. 30	7	14	21	28	35	42	49	56	63	70	7. 30
4. 40	7	14	21	28	36	43	50	57	64	71	7. 20
4. 50	7	14	22	29	36	43	50	58	65	72	7. 10
5. 0	7	15	22	29	36	44	51	58	66	73	7. 0
5. 30	7	15	22	30	37	45	52	60	67	74	6. 30
6. 0	7	15	22	30	37	45	52	60	67	75	6. 0

Add the Correction to the Moon's Longitude or Latitude, when the Motion in 12 Hours is decreasing; and subtract it from the same, when the Motion in 12 Hours is increasing.

A CATALOGUE of the Right Ascensions and Declinations of the principal fixed Stars of the first and second Magnitude, adapted to the Year 1767, with their Variations in Ten Years.

Names of the Stars.	Character.	Mag- nitude.	Rt. Ascension. in 10 Years.	Declination.	Decl. incre. or diminh. in 10 Years.
Extremity of the Wing of Pegasus, <i>Algenib</i> , —	γ	2	0. 19	13. 54 N	+3. 29
In the Head of the Phoenix, —	α	2	3. 41	43. 34 S	-3. 29
The bright Star in the Tail of the Whale, —	β	2	7. 59	19. 16 S	-3. 18
In the Girdle of Andromeda, —	β	2	14. 11	34. 23 N	+3. 14
The Spring of the River Eridanus, <i>Achernar</i> , —	α	1	22. 15	58. 25 S	-3. 5
In the Jaw of the Whale, —	α	2	42. 32	3. 10 N	+2. 28
In the Head of Medusa, <i>Algol</i> , —	β	2	43. 7	40. 3 N	+2. 26
The bright Star of Perseus, —	α	2	46. 58	49. 1 N	-2. 17
The South Eye of the Bull, <i>Aldebaran</i> , —	α	1	65. 39	16. 1 N	+1. 23
The bright Star in the Left Shoulder of Auriga, <i>Capella</i> , —	α	1	74. 52	45. 44 N	+0. 53
The bright Foot of Orion, <i>Rigel</i> , —	β	1	75. 44	8. 29 S	-0. 50
The North Horn of the Bull, —	β	2	77. 44	28. 23 N	+0. 43
The Western Shoulder of Orion, —	γ	2	78. 10	6. 7 N	+0. 42
Bright Star in the Dove, —	α	2	82. 48	34. 13 S	-0. 25
The Eastern Shoulder of Orion, —	α	1	85. 39	7. 21 N	+0. 16
The bright Star in the Poop of the Ship Argo, <i>Canopus</i> , —	α	1	94. 42	52. 34 S	+0. 16
The bright Star in the Dog's Mouth, <i>Sirius</i> , —	α	1	98. 44	16. 24 S	+0. 30
In the Head of the Northern Twin, <i>Caster</i> , —	α	1	102. 55	32. 23 N	-1. 7
The little Dog, <i>Procyon</i> , —	α	1	111. 47	5. 49 N	-1. 13
In the Head of the Southern Twin, <i>Pollux</i> , —	β	1	112. 46	28. 35 N	-1. 17

The bright Star in the Oars of the Ship Argo, —	β	1	137. 0	1. 52	68. 46 S	+2. 28
The Heart of the Female Hydra, —	α	2	139. 3	7. 24	7. 40 S	+2. 31
The Lion's Heart, <i>Rigulal</i> , —	α	1	148. 59	8. 6	13. 5 N	-2. 51
Northernmost Star in the Square of the great Bear, —	α	2	162. 17	9. 44	63. 0 N	-3. 10
The Lion's Tail, —	β	2	174. 18	7. 47	15. 52 N	-3. 19
Southernmost Star of the Croifers, or the Foot of the Crofs, —	α	1	183. 28	8. 3	61. 49 S	+3. 20
The Virgin's Spike, —	α	1	198. 15	7. 54	9. 56 S	+3. 10
The last Star in the Tail of the great Bear, —	η	2	204. 35	6. 1	50. 29 N	-3. 2
The Westernmost Foot of the Centaur, —	β	2	206. 54	10. 13	59. 14 S	+2. 59
The bright Star in Bootes, <i>Arcturus</i> , —	α	1	211. 15	7. 3	20. 24 N	-2. 52
The bright Star in the Eastern Foot of the Centaur, —	α	1	216. 1	11. 1	59. 52 S	+2. 42
The Southern Scale of Libra, —	α	2	219. 31	8. 16	15. 4 S	+2. 35
The Northern Star of Libra, —	β	2	226. 8	8. 3	8. 31 S	+2. 20
The bright Star of the Crown, —	α	2	231. 14	6. 20	27. 30 N	-2. 6
The Northernmost Star of the Scorpion's Forehead, —	β	2	237. 59	8. 40	19. 8 S	+1. 47
The Scorpion's Heart, <i>Antares</i> , —	α	1	243. 47	9. 8	25. 53 S	+1. 29
In the Eastern Knee of Ophiuchus, —	η	2	254. 16	8. 36	15. 25 S	+0. 55
The Head of Ophiuchus, —	α	2	261. 2	6. 57	12. 45 N	-0. 32
The bright Star of the Harp, <i>Lyra</i> , —	α	1	277. 16	5. 3	38. 35 N	+0. 25
The bright Star of the Eagle, <i>Ashir</i> , —	α	2	294. 52	7. 15	8. 16 N	+1. 23
The Eye of the Peacock, —	α	2	301. 47	12. 13	57. 28 S	-1. 44
The Tail of the Swan, —	α	2	308. 22	5. 7	44. 27 N	+2. 4
The Westernmost Wing of the Crane, —	α	2	328. 23	9. 56	48. 4 S	-2. 50
In the Mouth of the Southern Fish, <i>Pomelhaute</i> , —	α	1	341. 11	8. 21	30. 51 S	-3. 9
In the Shoulder of Pegasus, —	β	2	343. 8	7. 12	26. 50 N	+3. 11
In the Wing of Pegasus, <i>Markab</i> , —	α	1	343. 18	7. 27	13. 58 N	+3. 12
The Head of Andromeda, —	α	2	359. 6	7. 40	27. 48 N	+3. 20

A TABLE of the Multipliers of the Difference between the Moon's Longitude computed, and that inferred from Observation, to find the Error of the Ship's Account in Longitude.

Enter with hourly Motion of ☾, or Difference of hourly Motions of ☉ and ☾, according as ☾'s Distance is taken from a Star or the Sun.			
Ho. Mo. ☾ ordiffe. Ho. Mo. ☉ & ☾	Multi- pliers.	Ho. Mo. ☾ ordiffe. Ho. Mo. ☉ & ☾	Multi- pliers.
1 "		1 "	
25. 45	35,0	32. 0	28,1
26. 0	34,6	32. 15	27,9
26. 15	34,3	32. 30	27,7
26. 30	34,0	32. 45	27,5
26. 45	33,6		
27. 0	33,3	33. 0	27,3
27. 15	33,0	33. 15	27,1
27. 30	32,7	33. 30	26,9
27. 45	32,4	33. 45	26,7
28. 0	32,1	34. 0	26,5
28. 15	31,8	34. 15	26,3
28. 30	31,6	34. 30	26,1
28. 45	31,3	34. 45	25,9
29. 0	31,0	35. 0	25,7
29. 15	30,8	35. 15	25,5
29. 30	30,5	35. 30	25,3
29. 45	30,2	35. 45	25,2
30. 0	30,0	36. 0	25,0
30. 15	29,7	36. 15	24,8
30. 30	29,5	36. 30	24,7
30. 45	29,3	36. 45	24,5
31. 0	29,0	37. 0	24,3
31. 15	28,8	37. 15	24,2
31. 30	28,6	37. 30	24,0
31. 45	28,3	37. 45	23,8
		38. 0	23,7

A TABLE of the Depression or Dip of the Horizon of the Sea.

Elevation of the Eye above the Sea in Feet.	Depression of the Hori- zon of the Sea.
1	0. 57
2	1. 21
3	1. 39
4	1. 55
5	2. 8
6	2. 20
7	2. 31
8	2. 42
9	2. 52
10	3. 1
12	3. 18
14	3. 34
16	3. 49
18	4. 3
20	4. 16
22	4. 28
24	4. 40
26	4. 52
28	5. 3
30	5. 14
35	5. 39
40	6. 2
45	6. 24
50	6. 44
60	7. 23
70	7. 59
80	8. 32
90	9. 3
100	9. 33

Right Ascensions and Declinations of some of the principal fixed Stars.

Deduced from Dr. Bradley's Observations.

Jan. 1, 1767.	Right Ascensions.	Ann. Varia. in AR.	Declination.	Ann. Variation in Declination.	Magnitudes.
Stars Names.	° ' "	"	° ' "	"	
γ Pegasi —	0. 18. 58,4	46,20	13. 53. 15,3 N	+20,04	2
α Arietis —	28. 31. 18,4	50,06	22. 21. 02,5 N	+17,64	2
α Ceti —	42. 31. 53,1	46,93	3. 9. 44,1 N	+14,80	2
Aldebaran —	65. 38. 36,6	51,41	16. 1. 18,1 N	+8,32	1
Capella —	74. 52. 41,7	66,03	45. 43. 39,0 N	+5,28	1
Rigel —	75. 50. 13,8	43,30	8. 29. 15,4 S	-4,94	1
β Tauri —	77. 53. 44,6	56,80	28. 25. 17,7 N	+4,24	2
α Orionis —	85. 38. 28,4	48,75	7. 20. 35,9 N	+1,56	1
Sirius —	98. 43. 19,2	40,35	16. 24. 28,1 S	+3,10	1
Castor —	109. 55. 32,8	58,15	32. 22. 36,4 N	-6,80	2
Procyon —	111. 46. 33,3	48,08	5. 48. 32,1 N	-7,42	1
Pollux —	112. 45. 37,6	56,27	28. 34. 9,1 N	-7,72	2
Regulus —	148. 59. 12,7	48,60	13. 5. 49,6 N	-17,17	1
Spica Virginis —	198. 14. 15,0	47,27	9. 56. 17,0 S	+18,97	1
Arcturus —	211. 15. 49,2	42,32	20. 24. 31,9 N	-17,16	1
Antares —	243. 47. 25,3	54,92	25. 53. 36,3 S	+8,89	1
δ Sagittarii —	272. 10. 43,6	59,95	34. 28. 7,5 S	-0,72	2
α Aquilæ —	294. 51. 5,5	43,54	8. 16. 3,8 N	+8,40	1
2α Capricorni —	301. 16. 42,4	50,20	13. 15. 0,2 S	-10,40	3
Fomalhaut —	341. 10. 55,5	50,67	30. 51. 1,2 S	-18,97	1
α Pegasi —	343. 17. 35,7	44,75	13. 57. 20,4 N	+19,20	2

Longitudes and Latitudes of some of the principal fixed Stars.

Deduced from Dr. Bradley's Observations.

Jan. 1, 1767.	Longitude.	Latitude.	Magnitudes.
Stars Names.	° ' "	° ' "	
γ Pegasi ———	γ 5. 54. 38,5	12. 35. 34,5 N	2
α Arietis ———	δ 4. 24. 20,0	9. 57. 30,0 N	2
α Ceti ———	δ 11. 3. 56,0	12. 36. 16,0 S	2
Aldebaran ———	Π 6. 32. 02,5	5. 29. 02,0 S	1
Rigel ———	13. 34. 26,0	31. 9. 10,0 S	1
Capella ———	18. 36. 11,0	22. 51. 46,0 N	1
β Tauri ———	19. 19. 19,0	5. 21. 59,0 N	2
α Orionis ———	25. 30. 05,0	16. 3. 31,0 S	1
Sirius ———	\S 10. 52. 26,0	39. 32. 55,0 S	1
Castor ———	16. 59. 51,0	10. 4. 35,0 N	2
Pollux ———	20. 0. 16,0	6. 40. 04,5 N	2
Procyon ———	22. 34. 29,5	15. 58. 08,0 S	1
Regulus ———	\S 26. 35. 31,0	0. 27. 27,0 N	1
Spica Virginis ———	\S 20. 35. 32,0	2. 2. 11,0 S	1
Arcturus ———	20. 59. 04,0	30. 54. 10,5 N	1
Antares ———	τ 6. 30. 40,0	4. 32. 17,0 S	1
ϵ Sagittarii ———	ν 1. 49. 47,0	11. 0. 45,0 S	2
α Aquilæ ———	28. 29. 13,0	29. 18. 36,0 N	1
α Capricorni ———	π 0. 36. 19,0	6. 57. 16,0 N	3
Fomalhaut ———	χ 0. 34. 47,0	21. 6. 28,0 S	1
α Pegasi ———	20. 14. 30,0	19. 24. 37,5 N	2

NEW
T A B L E S
AND
R U L E S
FOR CORRECTING THE
APPARENT DISTANCE
OF THE
MOON FROM THE SUN
OR A
FIXED STAR,
ON ACCOUNT OF
REFRACTION AND PARALLAX.

BY MR. LYONS.

2 0 1 1 2 1

2 0 1

10 11 12 13 14 15

16 17 18 19 20

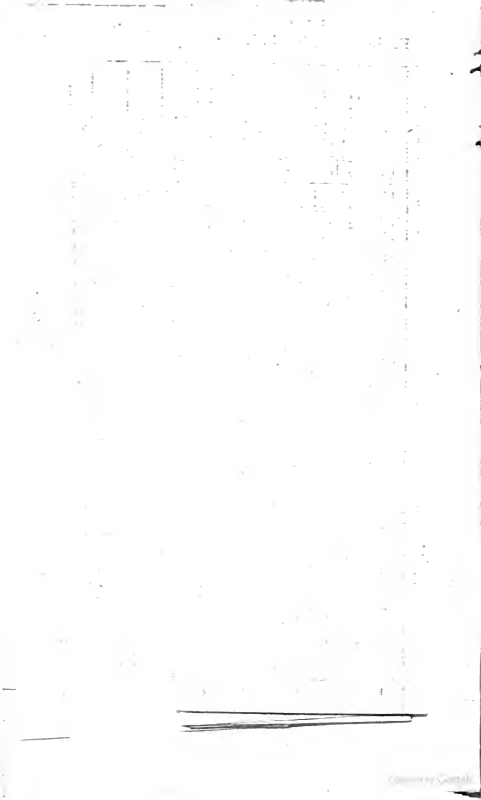
21 22 23 24 25 26 27 28 29 30

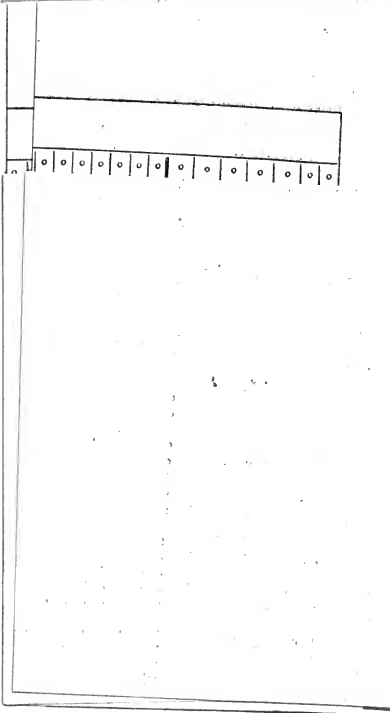
31 32 33 34 35 36 37 38 39 40

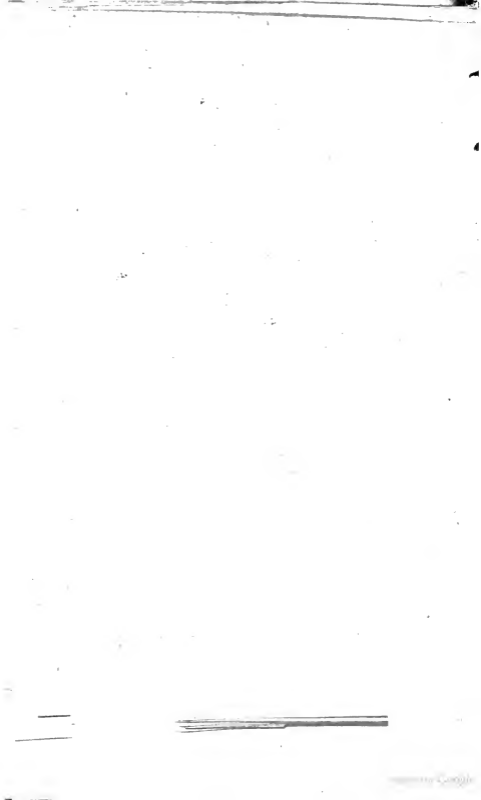
41 42 43 44 45 46 47 48 49 50

A TABLE into Seconds, and the contrary.

I	"	I	"	I	"	I	"
,01	1	,61	37	,76	46	,91	55
,02	1	,62	37	,77	46	,92	55
,03	2	,63	38	,78	47	,93	56
,04	2	,64	38	,79	47	,94	56
,05	3	,65	39	,80	48	,95	57
,06	4	,66	40	,81	49	,96	58
,07	4	,67	40	,82	49	,97	58
,08	5	,68	41	,83	50	,98	59
,09	5	,69	41	,84	50	,99	59







U S E
 OF THE PRECEDING
T A B L E S,
 WITH
R U L E S
 TO CLEAR THE
APPARENT DISTANCE
 OF THE
MOON FROM A STAR,
 OF THE EFFECTS OF
REFRACTION AND PARALLAX.

To find the Effect of Refraction.

IN Table I. find what Number answers to the two Altitudes of the Moon and Star, the lesser of the two Altitudes being found at the Top of the Table, the other in the first Column on the left Hand.

Prefix the Index 2 to this Number (considered as the decimal Part of a Logarithm) and add it to the logarithmic Cossecant of the apparent Distance of the Moon and Star; and, abating 10 from the Index of the Sum, find what natural Number answers to it in the Table of Logarithms.

From this Number subtract that corresponding to the given Distance, and to the lesser of the two Altitudes in Table II. if the Distance is less than 90° ; or add them together, if the Distance exceeds 90° ; the Remainder or Sum is the Effect

of Refraction in Seconds; which added to the observed Distance, gives the Distance cleared of Refraction.

In any of the Cases falling on the right Hand of the black waving Line, or if both Altitudes exceed 50° , the Effect of Refraction may be had at once by Table III.

To find the Effect of Parallax.

Add together the proportional Logarithm of the Moon's horizontal Parallax, the logarithmic Cosecant of the Star's Altitude corrected for Refraction, and the logarithmic Sine of the Distance cleared from Refraction; the Sum, abating 20 from the Index, will be the proportional Logarithm of a first Arc.

Add together the proportional Logarithm of the Moon's horizontal Parallax, the logarithmic Cosecant of the Moon's Altitude corrected for Refraction, and the Tangent of the Distance cleared from Refraction; the Sum, abating 20 from the Index, will be the proportional Logarithm of a second Arc.

Then, if the Distance is less than 90° , the Difference of these two Arcs is the principal Effect of Parallax (or Parallax in Distance); which added to or subtracted from the Distance corrected for Refraction, according as the first Arc is less or greater than the second, will give the Distance corrected for the principal Effect of Parallax.

But if the Distance exceeds 90° , the Sum of the two Arcs is to be taken instead of their Difference, and is to be subtracted from the Distance corrected for Refraction.

In Table IV. in the Column marked above with the Distance, find the two Numbers answering to the Parallax in Distance and in Altitude; their Difference is the second Correction of Parallax in Seconds; which, added to or subtracted from the Distance corrected for Refraction and principal Effect of Parallax, according as the Distance is less or greater than 90° , will give the correct or reduced Distance.

EXAMPLE I.

Let the apparent	0 . . "	The Moon's horizontal	0' 15"
Altitude of the	24. 48.	Parallax	56. 15
Star be . . .		And consequently Pa-	
Of the Moon's Centre	12. 30.	rallax in Altitude,	
Observed Distance		by p. 3d of Tables,	55
of the Moon's		is	
Centre from the	51. 28. 35		
Star			

In Table I. the Number answering to 24° and 12° of Altitude is 1411, and to 25 and 12 of Altitude is 1511; therefore 1° Increase of the greater Altitude produces an Increase of 100 in the tabular Number. Say then, by the Rule of Three, If 1° or 60' give 100, what will 48' (the Excess of the greater Altitude above 24°) give? the Answer is, 80; which, added to 1411, gives 1491, the Number corrected for exceeding Minutes of greater Altitude. Moreover, 24° and 12° of Altitude giving 1411, as above, and 24 and 13 giving 1232; therefore, 1° Increase of the lesser Altitude gives 179 Decrease of the tabular Number. Say therefore, by the Rule of Three, If 1° or 60' give 179, what will 30' (the Excess of the lesser Altitude above 12°) give? the Answer is, 89; which, subtracted from 1491 (the tabular Number corrected for exceeding Minutes of greater Altitude), leaves 1402 for the tabular Number corrected also for the exceeding Minutes of the lesser Altitude;

To which prefixing the Index 2, it will be . .	2.1402
Log. Cosec. observed Distance $51^{\circ} 28'$. .	10.1066
	<hr/>
	12.2468

Rejecting 10 from the Index, we have 2.2468, which is the Logarithm of 176".

In Table II. under the Column intituled 10° and above, answering to the Distance 51° is 90", and answering to 52° is 86"; therefore to $51^{\circ} 28'$ there answers 88"; which subtracted from 176", leaves the Effect of Refraction 88".

Observed Distance	51. 28. 35
Effect of Refraction	+ 1. 28
	<hr/>
Distance cleared of Refraction . . .	51. 30. 3

For

For Parallax.

App. Alt. of the Star	$\left. \begin{array}{l} 24^{\circ} 48' \end{array} \right\}$		App. Alt. of the Moon	$\left. \begin{array}{l} 12^{\circ} 30' \end{array} \right\}$	
Refraction in Alt. subtr.	$\left. \begin{array}{l} 2 \end{array} \right\}$		Refraction in Alt. subtr.	$\left. \begin{array}{l} 4 \end{array} \right\}$	
Alt. corr. for Refraction	$\left. \begin{array}{l} 24^{\circ} 46' \end{array} \right\}$		Alt. corr. for Refraction	$\left. \begin{array}{l} 12^{\circ} 26' \end{array} \right\}$	
Cofecant $24^{\circ} 46'$	10.3778		Cofecant $12^{\circ} 26'$	10.6669	
Sine dist. $51^{\circ} 30'$	9.8935		Tang. dist. $51^{\circ} 30'$	10.0994	
Proportional Log. of horizontal Parallax $56'. 15''$	$\left. \begin{array}{l} 0.5051 \end{array} \right\}$		Proportional Log. of horizontal Parallax $56'. 15''$	$\left. \begin{array}{l} 0.5051 \end{array} \right\}$	
	20.9214			21.2714	

Rejecting 20 from these Sums,

The Arc answering to the propor. Log. 9214 is $30^{\circ} 7'$
 1.2714 is $9^{\circ} 38'$

Their Difference $20.29'$ is the principal Effect of Parallax, or Parallax in Distance, to be subtracted; because the first Arc is greater than the second.

Distance corrected for Refraction	$51^{\circ} 30' 3''$
Parallax in Distance	$- 20.29'$

Distance corrected for Refract. and Par. in Dist. $51^{\circ} 9' 34''$

In Table IV. under 51° , and against $55'$ the Parallax in Altitude is $20''$; in the same Column against $20'$ the Parallax in Distance is $3''$; which subtracted from $20''$, leaves $17''$, for the second Correction of Parallax, to be added:

$51^{\circ} 9' 34''$
$+ 17''$

Reduced Dist. cleared both of Refr. and Par. $51^{\circ} 9' 51''$

N. B. The proportional Parts for the Minutes of the two Altitudes in Table I. may be found also by the Rule of Practice, or by Decimal Multiplication, as well as by the Rule of Three. Thus, to find the proportional Part answering

ing to $48'$, the Excess of the greater Altitude above 48° , I find, by the Rule of Practice, if 1° , or $60'$, give the Difference 100, $30'$ will give 50, $15'$ will give 25, and $3'$ will give 5; therefore $48'$ will give $30 + 15 + 5 = 80$, as before. Or, by Decimal Multiplication, considering that $48'$ is $\frac{1}{10}$ of $60'$, I multiply the Difference 100 by $\frac{1}{10}$, which gives the Product 80, as before. The decimal Part any Number of Minutes is of $60'$, may be seen at one Corner of Table I. against the given Number of Minutes found in the Column there marked for Seconds.

EXAMPLE II.

Let apparent Alt. of the Star be	$\left. \begin{array}{l} 0^\circ 15' 25'' \\ 27^\circ 30' \end{array} \right\}$	The Moon's horizontal Parallax	$\left. \begin{array}{l} 57' 3'' \\ 51. \end{array} \right\}$
Of the Moon's Centre		Whence the Parallax in Altitude, by p. 3d	
Ap. Dist. of the Star from the Moon's Centre	$\left. \begin{array}{l} 102^\circ 30' 0'' \\ \end{array} \right\}$		

The Number in Table I. for the Altitudes 27° and 15° is 1176, the Difference for 1° Increase of the greater Altitude being + 75, and of the lesser Altitude — 123; whence the Correction for the Excess $30'$ of the greater Altitude is + 37, and the Correction for the Excess $25'$ of the lesser Altitude is — 51.

Whence the Number from Table I. corrected, is
 $1176 + 37 - 51 = 1162$, or prefixing the Index 2, is 2.1162
 Coscant of Dist. $102^\circ 30' =$ Coscant $77^\circ 30'$, 10.0104
 the Supplement to 180°
 72.1266

Rejecting 10 from the Index is Log. of . . . 134
 Number in Table II. to be added, because Distance is above 90° . . . } + 25

Effect of Refraction $159 = 2'. 39''$

Observed Distance $102^\circ 30' 0''$
 Effect of Refraction + 2. 39

Distance cleared of Refraction $102^\circ 32' 39''$

For

For Parallax.

Prop. Log. of horiz. Parallax 57'. 3"	0.4990	Propor. Log. of the Moon's hor. Par.	0.4990
Cofec. of the Star's app. Alt. 15°. 25'	10.5768	Cofec. of the Moon's app. Alt. 27°. 30'	10.3356
— Refract. 3' =		— Refract. 2' =	
15°. 22'		27°. 28'	
Sine Dist. cleared of Refract. 102°. 33'	9.9895	Tang. Dist. clear of Refract. 102°. 33'	10.6524
or 77°. 27', its Supplem. to 180°		or 77°. 27', its Supplem. to 180°	
Prop. Log. of 15. 32	20.0653	Prop. Log. of 5'. 52"	21.4870
or Arc 1st		or Arc 2d	
Arc 2d to be add- ed, be- cause Dist. is above 90°	+ 5. 52		
Principal Effect of Par. or Par. in Dist.	21. 24		

In Table IV. Parallax in Altitude 51 gives 5
Parallax in Distance 21 . . . 1

Difference 4

Distance cleared of Refraction 102. 32. 39
Parallax in Distance to be subtracted, because
Distance is above 90° } — 21. 24

Second Correction of Parallax to be subtracted, }
because Distance is above 90° } — 4

Distance reduced, or cleared both of Refraction }
and Parallax } 102. 11. 31

EXAMPLE

EXAMPLE III.

Let app. Alt. of the Star be .	} 48. 20. "	The horizontal Parallax . . .	} 0. 55. 29
Of the Moon . .	64. 30.	Whence the Par. in Altitude .	} 0. 23.
The observed Dist.	33. 15.	The Star's Alt. corrected by Refr.	} 48. 19.
Effect of Refract. by Table III.	} + 0. 34	The Moon's Alt. contr. by Refr.	} 64. 30.
Distance cleared of Refraction .	} 33. 15. 34		
Prop. Log. hor. Par.	0.5111	Prop. Log. hor. Par.	0.5111
Cofecant of the Star's Alt. corrected by Refract. 48°. 19'	} 10.1268	Cofec. of the Moon's Alt. corrected by Refract. 64°. 30'	} 10.0449
Sine Dist. 33°. 16'	9.7392	Tang. Dist. 33°. 16'	9.8169
			20.3725
Prop. Log. Arc first 75'. 32"	} 20.3771	Prop. Log. Arc 2d } 76. 20	
		Arc first . .	75. 32
		Par. in Dist.	0. 48

Table IV. Parallax in Altitude 23 gives 7
Parallax in Distance 1 . . 0

Second Correction of Parallax. . . .	7	
Distance cleared of Refraction	33. 15. 34	
Parallax in Distance	+ 0. 48	
		33. 16. 22
Second Correction of Parallax	+ 7	
Distance reduced		33. 16. 29

EXAMPLE IV.

Let the app. Alt. of the Star be } $53^{\circ} 13'$	The Moon's horizontal Parallax . . } $61'' 9''$
Of the Moon . . . $64^{\circ} 38'$	Whence the Moon's Parallax in Altitude } $26'' 0''$
The app. Distance } $56^{\circ} 17' 44''$	
Table III. } $+ 1'' 1''$	
Distance cleared of Refraction } $56^{\circ} 18' 45''$	
Propor. Log. of the Moon's horizontal Parallax $61' 9''$ } 0.4689	Propor. Log. of the Moon's horizontal Parallax $61' 9''$ } 0.4689
Cofecant of the Star's Alt. corrected by Refract. $53^{\circ} 12'$ } 10.0965	Cofec. of the Moon's Altitude corrected $64^{\circ} 38'$. } 10.0440
Sine Dist. cleared of Refract. $56^{\circ} 19'$ } 9.9202	Tang. Dist. cleared of Refr. $56^{\circ} 19'$ } 10.1762
Prop. Log. of $58^{\circ} 50'$ or first Arc } 20.4856	Prop. Log. of $35' 50''$ or second Arc } 20.6891
Second Arc $36^{\circ} 50'$	
Par. in Dist. $22'' 0''$	

Table IV. Parallax in Altitude $26'$ gives $4''$
 Parallax in Distance $22''$. . . $3''$

Second Correction of Parallax $1''$

Distance cleared of Refraction $56^{\circ} 18' 45''$
 Parallax in Distance $- 22'' 0''$

Second Correction of Parallax $55^{\circ} 56' 45''$
 $+ 1''$

Distance cleared of Refraction and Parallax . . $55^{\circ} 56' 46''$

REMARKS.

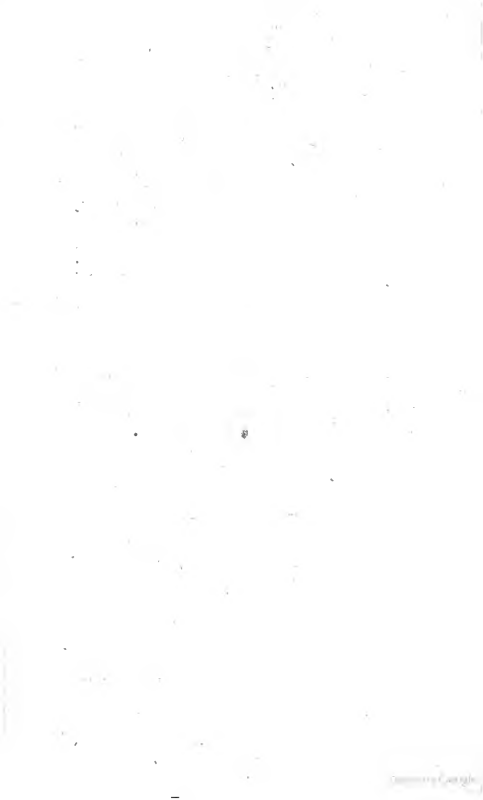
REMARKS.

I. In computing the Effect of Refraction, three Places of Figures, besides the Index, will generally be sufficient for Table I. but for finding the Effect of Parallax, the Sines &c. ought to be taken to four Places of Figures, besides the Index.

II. Sherwin's Logarithms are the most convenient and exact for these and other Calculations; but if a Set of Logarithms be used, having no Cosecants, they are easily found, by taking the Complement of the logarithmic Sine to 20.0000. Thus, to find the Cosecant of $48^{\circ} 19'$, subtract its logarithmic Sine 9.8732 from 20.0000, the Remainder 10.1268 is the Cosecant required, as above in Example III.

III. If the Index of the proportional Logarithm of Arc first or second for Parallax come out 19, so that 20 cannot be thrown off, add 0.3010, or the Logarithm of 2 to the Sum of the Logarithms, and then abating 20 from the Index, find what Number it answers to in the Table of proportional Logarithms; which doubled, gives Arc the first or second.

IV. If the Moon's Distance was taken from the Sun instead of a Star, for Star read Sun in the preceding Rules.



SUPPLEMENTAL
T A B L E S

TO BE USED FOR CORRECTING

THE II^D AND III^D TABLES

F O R

R E F R A C T I O N,

AND FOR FINDING THE EFFECT OF THE

S U N ' S P A R A L L A X,

WHERE IT IS REQUIRED TO HAVE

THE RESULT TRUE TO A SECOND.

BY MR. LYONS.

TABLE I. Supplemental, continued, [31]

Shewing what Number of Seconds is to be subſtracted from the Number in Table II. on account of the greater Altitude of the Moon or Star, when under 30°.

[illegible]

TABLE II. Supplemental, continued, [33]

Shewing what Number of Seconds is to be added to the Number in Table II. standing under 10 Degrees, when the lesser Altitude is above 10 Degrees.

Distance.	Lesser Altitude of the Moon or Star.									
	21	22	23	24	25	26	27	28	29	30 or above
°	"	"	"	"	"	"	"	"	"	"
10	6	7	7	7	7	7	7	7	7	7
11	6	6	6	6	6	6	6	7	7	7
12	5	5	6	6	6	6	6	6	6	6
13	5	5	5	5	5	5	5	6	6	6
14	4	5	5	5	5	5	5	5	5	5
15	4	4	4	4	4	4	5	5	5	5
16	4	4	4	4	4	4	4	5	5	5
17	4	4	4	4	4	4	4	4	4	4
18	3	3	4	4	4	4	4	4	4	4
19	3	3	3	3	3	3	3	4	4	4
20	3	3	3	3	3	3	3	3	3	3
21	3	3	3	3	3	3	3	3	3	3
22	3	3	3	3	3	3	3	3	3	3
23	3	3	3	3	3	3	3	3	3	3
24	2	3	3	3	3	3	3	3	3	3
25	2	2	2	2	2	2	3	3	3	3
26	2	2	2	2	2	2	3	3	3	3
27	2	2	2	2	2	2	2	3	3	3
28	2	2	2	2	2	2	2	2	2	2
29	2	2	2	2	2	2	2	2	2	2
30	2	2	2	2	2	2	2	2	2	2
35	1	2	2	2	2	2	2	2	2	2
40	1	1	1	1	1	1	1	2	2	2
45	1	1	1	1	1	1	1	1	1	1
50	1	1	1	1	1	1	1	1	1	1
55	1	1	1	1	1	1	1	1	1	1
60	1	1	1	1	1	1	1	1	1	1
70	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0

[34] TABLE III. Supplemental.

This Table, jointly with the following, is for finding the Correction of Table III.

This Table gives the Number for entering the first upright Column of the following Table.

Alt.	50	51	52	53	54	55	56	57	58	59	60	61
0	"	"	"	"	"	"	"	"	"	"	"	"
50	0	0	"	"	"	"	"	"	"	"	"	"
51	0	0	"	"	"	"	"	"	"	"	"	"
52	0,1	0	0	0	"	"	"	"	"	"	"	"
53	0,1	0,1	0	0	0	"	"	"	"	"	"	"
54	0,2	0,1	0,1	0	0,1	0	"	"	"	"	"	"
55	0,3	0,2	0,2	0,1	0,1	0	"	"	"	"	"	"
56	0,4	0,3	0,3	0,2	0,1	0,1	0	"	"	"	"	"
57	0,5	0,4	0,4	0,3	0,2	0,1	0,1	0	"	"	"	"
58	0,6	0,5	0,4	0,4	0,3	0,2	0,1	0,1	0	"	"	"
59	0,8	0,6	0,5	0,4	0,3	0,2	0,2	0,1	0,1	0	"	"
60	0,9	0,7	0,6	0,5	0,3	0,2	0,2	0,1	0,1	0	0	"
61	1,0	0,9	0,7	0,6	0,4	0,3	0,2	0,2	0,2	0,1	0,1	0
62	1,2	1,0	0,8	0,6	0,5	0,3	0,2	0,2	0,2	0,1	0,1	0
63	1,3	1,1	0,9	0,7	0,6	0,4	0,3	0,3	0,2	0,1	0,1	0,1
64	1,5	1,3	1,1	0,9	0,7	0,5	0,4	0,3	0,3	0,2	0,1	0,1
65	1,6	1,4	1,2	1,0	0,8	0,6	0,5	0,4	0,3	0,2	0,1	0,1
66	1,8	1,6	1,4	1,1	0,9	0,7	0,6	0,5	0,3	0,2	0,1	0,1
67	1,9	1,7	1,5	1,2	1,0	0,8	0,7	0,6	0,4	0,3	0,2	0,2
68	2,1	1,9	1,6	1,4	1,1	0,9	0,8	0,7	0,5	0,4	0,3	0,2
69	2,2	2,0	1,7	1,5	1,2	1,0	0,9	0,7	0,6	0,4	0,3	0,3
70	2,4	2,1	1,8	1,6	1,3	1,1	1,0	0,8	0,7	0,5	0,4	0,3
71	2,5	2,2	2,0	1,7	1,5	1,2	1,1	0,9	0,8	0,6	0,5	0,4
72	2,7	2,4	2,1	1,9	1,6	1,3	1,1	1,0	0,8	0,7	0,5	0,4
73	2,8	2,5	2,2	2,0	1,7	1,4	1,2	1,1	0,9	0,8	0,6	0,5
74	3,0	2,7	2,4	2,1	1,8	1,5	1,3	1,1	1,0	0,8	0,6	0,5
75	3,1	2,8	2,5	2,2	1,9	1,6	1,4	1,2	1,1	0,9	0,7	0,6
76	3,2	2,9	2,6	2,3	2,0	1,7	1,5	1,3	1,2	1,0	0,8	0,7
77	3,3	3,0	2,7	2,4	2,1	1,8	1,6	1,4	1,2	1,0	0,8	0,7
78	3,4	3,1	2,8	2,4	2,1	1,8	1,6	1,4	1,3	1,1	0,9	0,8
79	3,5	3,2	2,9	2,5	2,2	1,9	1,7	1,5	1,3	1,1	0,9	0,8
80	3,6	3,3	2,9	2,6	2,3	2,0	1,8	1,6	1,4	1,2	1,0	0,8
81	3,7	3,4	2,9	2,6	2,3	2,0	1,8	1,6	1,4	1,2	1,0	0,9
82	3,8	3,5	3,0	2,7	2,4	2,1	1,9	1,6	1,4	1,3	1,1	0,9
83	3,9	3,5	3,1	2,7	2,4	2,1	1,9	1,6	1,4	1,3	1,1	1,0
84	4,0	3,6	3,2	2,8	2,5	2,2	2,0	1,7	1,5	1,4	1,2	1,0
85	4,0	3,6	3,2	2,8	2,5	2,2	2,0	1,8	1,5	1,4	1,2	1,0
90	4,1	3,7	3,3	2,9	2,6	2,3	2,1	1,9	1,6	1,4	1,2	1,1

TABLE III. Supplemental, continued. [35]

This Table, jointly with the following, is for finding the Correction of Table III.

This Table gives the Number for entering the first upright Column of the following Table.

Alt.	62	63	64	65	66	67	68	69	70	75	80	85	90
0													
50													
51													
52													
53													
54													
55													
56													
57													
58													
59													
60													
61	"												
62	0	"											
63	0	0	"										
64	0	0	0	"									
65	0,1	0	0	0	"								
66	0,1	0	0	0	0	"							
67	0,1	0,1	0	0	0	0	"						
68	0,2	0,1	0	0	0	0	0	"					
69	0,2	0,2	0,1	0,1	0,1	0	0	0	"				
70	0,3	0,2	0,2	0,1	0,1	0,1	0	0	0	"			
71	0,3	0,3	0,2	0,1	0,1	0,1	0	0	0		"		
72	0,4	0,3	0,3	0,2	0,2	0,1	0,1	0	0	0		"	
73	0,4	0,4	0,3	0,2	0,2	0,1	0,1	0	0	0			"
74	0,5	0,4	0,3	0,3	0,3	0,2	0,2	0,1	0,1	0			
75	0,5	0,4	0,4	0,3	0,3	0,2	0,2	0,1	0,1	0			
76	0,6	0,5	0,4	0,3	0,3	0,2	0,2	0,1	0,1	0	0		
77	0,6	0,5	0,4	0,3	0,3	0,2	0,2	0,1	0,1	0	0	0	
78	0,7	0,6	0,5	0,4	0,3	0,3	0,2	0,1	0,1	0	0	0	
79	0,7	0,6	0,5	0,4	0,3	0,3	0,2	0,1	0,1	0	0	0	
80	0,7	0,6	0,5	0,4	0,3	0,3	0,2	0,1	0,1	0	0	0	
81	0,7	0,6	0,5	0,4	0,3	0,3	0,2	0,1	0,1	0	0	0	
82	0,8	0,7	0,6	0,4	0,3	0,3	0,2	0,1	0,1	0	0	0	
83	0,8	0,7	0,6	0,5	0,4	0,4	0,3	0,2	0,2	0,1	0	0	
84	0,8	0,7	0,6	0,5	0,4	0,4	0,3	0,2	0,2	0,1	0	0	
85	0,8	0,7	0,6	0,5	0,4	0,4	0,3	0,2	0,2	0,1	0	0	
90	0,9	0,8	0,7	0,6	0,5	0,5	0,4	0,3	0,2	0,1	0	0	0

TABLE IV. Supplemental,

For finding the Correction to be added to Table III. where both Altitudes are above 50 Degrees.

[illegible]

TABLE V. Supplemental.
For the Effect of the Sun's Parallax.

Apparent Distance of the Sun and Moon.													
Subtract from apparent Distance.													
Alt.	30	35	40	45	50	55	60	65	70	75	80	85	90
5	2	1	1	1	1	1	1	1	1	1	1	1	1
10	3	3	2	2	2	2	2	2	2	2	2	2	2
15	5	4	4	3	3	3	3	3	2	2	2	2	2
20	6	5	5	4	4	4	3	3	3	3	3	3	3
25	7	6	6	5	5	5	4	4	4	4	4	4	4
30	9	8	7	6	6	5	5	5	5	4	4	4	4
35	10	9	8	7	7	6	6	6	5	5	5	5	5
40	11	10	9	8	7	7	6	6	6	6	6	6	6
45	12	11	10	9	8	8	7	7	7	6	6	6	6
50	13	12	10	10	9	8	8	7	7	7	7	7	7
55	14	13	11	10	9	9	8	8	8	8	7	7	7
60	15	13	12	11	10	9	9	8	8	8	8	8	8
65	16	14	12	11	10	10	9	9	8	8	8	8	8
70	17	15	13	12	11	10	10	9	9	9	9	8	8
75	17	15	13	12	11	10	10	9	9	9	9	9	8
80	17	15	13	12	11	11	10	10	9	9	9	9	9
85	18	16	14	12	11	11	10	10	9	9	9	9	9
90	18	16	14	12	11	11	10	10	9	9	9	9	9
							120	115	110	105	100	95	90
							App. Dist. of the Sun and Moon.						
							Subtract from app. Distance.						

TABLE VI. Supplemental.
For the Effect of the Sun's Parallax.

Apparent Distance of the Sun and Moon.													
Add to apparent Distance.													
Alt. ☉	° 30	° 35	° 40	° 45	° 50	° 55	° 60	° 65	° 70	° 75	° 80	° 85	° 90
°	//	//	//	//	//	//	//	//	//	//	//	//	//
5	1	1	1	1	1	0	0	0	0	0	0	0	0
10	3	2	2	2	1	1	1	1	1	0	0	0	0
15	4	3	3	2	2	2	1	1	1	0	0	0	0
20	5	4	4	3	2	2	2	1	1	1	0	0	0
25	6	5	4	4	3	2	2	2	1	1	1	0	0
30	8	6	5	4	4	3	2	2	2	1	1	0	0
35	9	7	6	5	4	3	3	2	2	1	1	0	0
40	10	8	7	6	5	4	3	3	2	2	1	0	0
45	11	9	7	6	5	4	4	3	2	2	1	1	0
50	12	10	8	7	6	5	4	3	2	2	1	1	0
55	13	10	8	7	6	5	4	3	3	2	1	1	0
60	13	11	9	8	6	5	4	4	3	2	1	1	0
65	14	11	9	8	7	6	5	4	3	2	1	1	0
70	14	12	10	8	7	6	5	4	3	2	1	1	0
75	15	12	10	8	7	6	5	4	3	2	2	1	0
80	15	13	10	9	7	6	5	4	3	2	2	1	0
85	15	13	10	9	7	6	5	4	3	2	2	1	0
90	15	13	11	9	7	6	5	4	3	2	2	1	0
							120	115	110	105	100	95	90
							App. Dist. of the Sun and Moon.						
							Subtract from app. Distance.						

E X P L I C A T I O N

OF THE USE OF THE

SUPPLEMENTAL TABLES.

THESE Tables are only necessary to be used where the utmost Accuracy is required; and therefore may very well be omitted in common Practice, since the Effect of them will never amount to $10''$ (and generally much less) if the greater of the two Altitudes of the Moon and Star be 10° or above, as it can scarcely ever be less. Their Titles almost sufficiently explain their Use: nevertheless, it may be proper to add the following Directions concerning them.

Tables I. and II. Supplemental, are to be both used in correcting Table II. of Refraction. Enter Table I. Supplemental with greater Altitude of the Moon or Star at Top; and Distance on the Side, the corresponding Number of Seconds is to be subtracted from that taken out of Table II. of Refraction. Then enter Table II. Supplemental with lesser Altitude of the Moon or Star at Top, and Distance on the Side, the corresponding Number of Seconds added to Number in Table II. of Refraction, first already corrected for Table I. Supplemental, gives the Number in Table II. of Refraction corrected, which must be applied as before.

Note. That when the utmost Accuracy is required, Tables I. and II. of Refraction are to be used together with the two first supplemental Tables, if one or both Altitudes are under 50° , as well in the Cases falling to the right Hand of the black waving Line as in the rest of the Table; and Table III. of Refraction is only to be used, where both Altitudes are above 50° . In this Case, and this Case only, Tables III. and IV. Supplemental are to be used for correcting Table III. of Refraction. Enter Table III. Supplemental with lesser Altitude

titude of the Moon or Star at the Top, and greater Altitude on the Side, and take out the corresponding Number; with which enter Table IV. Supplemental on the Side, and entering the same Table with the Distance on the Top, the corresponding Number of Seconds is the Correction to be added to Table III. of Refraction.

The two last Tables, or V. and VI. Supplemental, serve for correcting the observed Distance of the Moon from the Sun, on account of the Sun's Parallax; their joint Effect cannot exceed 9". Enter Table V. Supplemental with the Moon's Altitude on the Side, and the Distance at the Top; and enter Table VI. Supplemental with the Sun's Altitude on the Side, and Distance at the Top. The two Numbers so taken out, applied with their proper Signs respectively, according to the Directions indicated by the Tables, to the Distance already corrected by the preceding Tables and Rules, give the Distance further corrected on account of the Sun's Parallax.

Here follow the four Examples wrought before, according to the four principal Tables, corrected by the supplemental Tables.

EXAMPLE I. corrected.

The greater Altitude, namely that of the Star, being $24^{\circ}.48'$, and the Distance $51\frac{1}{2}^{\circ}$, the Correction of Table II. Supplemental is 0; the lesser Altitude, namely of the Moon, being $12^{\circ}.30'$, and the Distance $51\frac{1}{2}^{\circ}$, Table II. Supplemental also gives 0; so that the Number found by Table II. of Refraction, and consequently the Effect of Refraction, as found before, appears to be exact, without needing any further Correction.

Suppose now, that, instead of a Star, it had been the Sun, from which this Distance of the Moon was taken. Entering Table V. Supplemental with the Moon's Altitude $12\frac{1}{2}^{\circ}$ on the Side, and Distance $51\frac{1}{2}^{\circ}$ at the Top, the corresponding Number of Seconds is $2''$, to be subtracted. In like Manner entering Table VI. with the Sun's Altitude $24^{\circ}.48'$ on the Side, and Distance $51\frac{1}{2}^{\circ}$ at Top, the Number of Seconds comes out $3''$, to be added. Therefore $51^{\circ}.9'.51'' - 2'' + 3'' = 51^{\circ}.9'.52''$, the reduced Distance correct.

EXAMPLE II. corrected.

The greater Altitude, namely that of the Moon, being $27\frac{1}{2}^{\circ}$, and the Distance $102\frac{1}{2}^{\circ}$, Table I. Supplemental gives 0; the lesser Altitude, namely that of the Star, being $15^{\circ} 25'$, and the Distance as before $102\frac{1}{2}^{\circ}$; Table II. also gives 0; whence the Effect of Refraction found before is exact.

Suppose now, that this had been the Moon's Distance from the Sun, instead of a Star, to correct the Distance further for the Effect of the Sun's Parallax, entering Table V. with $28^{\circ} 19'$, the Moon's Altitude corrected both for Refraction and Parallax, and $102^{\circ} 11'$, the Distance corrected, you find $4''$, to be subtracted. Entering Table VI. Supplemental with the Sun's Altitude $15^{\circ} 22'$, and Distance $102^{\circ} 11'$, you find $0''$; whence $102^{\circ} 11'. 11'' - 4'' = 102^{\circ} 11'. 7''$, the Distance of the Moon from the Sun reduced or finally corrected.

EXAMPLE III. corrected.

One of the Altitudes, namely that of the Moon being under 50° . This Case, though falling to the right-hand Side of the black waving Line, must not be computed by Table III. but by Tables I. and II. of Refraction, corrected by Tables I. and II. Supplemental; because the utmost Accuracy is supposed to be required.

Table I. gives $0641 + 2 - 6 = 0637$, to which	} 2.0637
prefix the Index 2, it is	
Cofecant Distance $33^{\circ} 15'$	10.2610
<hr/>	
Logarithm of 211	42.3247

The Number in Table II. in the Column intituled 10° and above, to Distance 33° being $174''$, and to Distance 34° , being $167''$, to $33^{\circ} 14'$, there will answer $172''$; but this must be corrected by Tables I. and II. Supplemental.

The greater Altitude being above 30° , Table I. Supplemental gives 0; the lesser Altitude being above 30° , and the Distance being 33° , Table II. gives $2''$, to be added to $172''$, makes $174''$, to be subtracted from $211''$, the Remainder $37''$ is the Effect of Refraction to be added to the observed Distance $33^{\circ} 15'. 0''$ gives the Distance cleared of Refraction $33^{\circ} 15'. 37''$, or $3''$ greater than found before by the applying Table III. only. The Calculation of the Effect of Parallax

Parallax will not be altered hereby, so that the reduced Distance will come out $3''$ greater than before, or $33^{\circ}. 16'. 32''$.

Suppose now the Distance was that of the Moon from the Sun, and not from a Star, to find the Effect of the Sun's Parallax, the Moon's Altitude corrected for Refraction and Parallax being $64^{\circ}. 53'$, and the Distance above corrected $33^{\circ}. 16'$, Table V. Supplemental gives $15''$, to be subtracted; and the Sun's Altitude corrected being $48^{\circ}. 19'$, Table VI. Supplemental gives $10''$, to be added. Therefore $33^{\circ}. 16'. 32'' - 15'' + 10'' = 33^{\circ}. 16'. 27''$, the reduced or correct Distance of the Moon from the Sun.

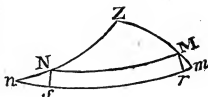
EXAMPLE IV. corrected.

Table III. Supplemental answering to the Altitude 65° and 53° , gives $1''. 0$; with which entering Table IV. Supplemental on the Side, and with the Distance 56° at the Top, there will be found $1''$, to be added to $61''$, the Number found by Table III. or it will come to the same thing, if it be added to the Distance above cleared of Refraction and Parallax, viz. $55^{\circ}. 56'. 46''$; whence the Distance further corrected will be $55^{\circ}. 56'. 47''$.

INVESTIGATION
OF THE
T A B L E S
AND
R U L E S
FOR FINDING THE EFFECT OF
R E F R A C T I O N
AND
P A R A L L A X
UPON THE
MOON'S DISTANCE FROM A STAR.

LET Z be the Zenith, M the Moon, its Alt. $= \mu$, N the Star, its Altitude $= \nu$, Sine $\mu = M$, Cofine $\mu = m$, Sine $\nu = N$, Cofine $\nu = n$, Distance $MN = \delta$,

its Sine $= D$, and Cofine $= d$, Radius $= 1$. Putting μ to express the Refraction in Altitude Mm at the Altitude μ , and ν the Refraction in Altitude Nn at the Altitude ν , and drawing the Arches Ns , Mr perpendicular to the true Distance mn , the Distance is contracted by Refraction, by the Quantity



$$\text{Quantity } n + m r = N n \times \text{Cof. } n + M m \times \text{Cof. } m = \nu \\ \times \frac{M - dN}{D n} + \mu \times \frac{N - dM}{D m} = \frac{1}{D} \times \frac{M \nu}{n} + \frac{N \mu}{m} - \frac{d}{D} \\ \times \frac{N \nu}{n} + \frac{M \mu}{m}.$$

The Logarithms of $\frac{M \nu}{n} + \frac{N \mu}{m}$ are contained in Table I. to which the logarithmic Cofecant of the Distance, or the Logarithm of $\frac{1}{D}$ being added, the Sum is the Logarithm of the Quantity $\frac{1}{D} \times \frac{M \nu}{n} + \frac{N \mu}{m}$, or the first Part of the Formula above.

As the greater of the two Altitudes (suppose μ) can scarcely be less than 10° , $\frac{M \mu}{m}$ may be considered as a constant Quantity $= 57''$, the Refraction at the Altitude of 45° , which put $= \epsilon$; for, according to Dr. Bradley's Rule, $\mu = 57'' \times \text{Cotang. } \mu + 3 \mu = 57'' \times \frac{m}{M}$ nearly, when μ is 10° or more, and consequently $\frac{M \mu}{m} = 57'' = \epsilon$, whence the second

Part of the Formula $\frac{d}{D} \times \frac{N \nu}{n} + \frac{M \mu}{m} = \frac{d}{D} \times \frac{N \nu}{n} + \epsilon$ very nearly, ν being taken as the lesser Altitude, the Values of which Expression are contained in Table II.

Supposing the Refraction in Altitude to be accurately as the Tangents of the Zenith Distances, as they are very nearly for Altitudes above 10° , $\mu = \frac{\epsilon m}{M}$ and $\nu = \frac{\epsilon n}{N}$, which substituted in the general Formula, it becomes $\frac{1}{D} \times \frac{\epsilon M}{N} + \frac{\epsilon N}{M} - \frac{d}{D} \times 2 \epsilon$, and substituting for the Cotang. $\frac{d}{D}$ it is equal $\frac{1}{D} - t$, t being the Tangent of Half the Distance, or $\frac{1}{2} \delta$, the general Formula is reduced to the following Expression, $\frac{\epsilon}{D} \times \frac{M}{N} + \frac{N}{M} - 2 + 2 \epsilon t = 2 \epsilon t + \frac{\epsilon}{D} \times \frac{M - N}{MN}$.

If

If both Altitudes are above 50° , the Quantity $\frac{e}{D} \times \frac{M - N}{MN}$ will never exceed $8''$; and therefore the Effect of Refraction may be taken $= 2e$, the Values of which are contained in Table III.

The Case is the same with respect to all the Places falling to the right Hand of the black waving Line in Table I. which therefore will also be found at once by Table III.

When the utmost Accuracy is required, some small Corrections must be made to Tables I, II, and III, of Refraction, these are contained in the four first supplemental Tables, and are readily to be taken out at Sight. The Foundation of them is as follows. μ being $= e \times \text{Cotang. } \mu + 3\mu = e$

$\times \frac{m}{M} - \frac{3\mu}{M^2}$, nearly $=$ (or for μ substituting its approximate

Value $\frac{e}{M}$, $= e \times \frac{m}{M} - \frac{3em}{M^2}$, it is plain that $\frac{M\mu}{m} = e - \frac{3e^2}{M^2}$.

In like Manner $\frac{N\nu}{n} = e - \frac{3e^2}{N^2}$. Whence $\frac{d}{D} \times \frac{N\nu}{n} + \frac{M\mu}{m}$, the second Part of the general Formula, may be taken for Altitudes above 10° , very accurately, to be $= \frac{d}{D}$

$\times 2e - \frac{3e^2}{M^2} - \frac{3e^2}{N^2}$. But the Numbers in Table II. standing in the last Column, intituled 10° and above, are $= \frac{d}{D} \times 112'',5$.

and the Expression just found above is $= \frac{d}{D} \times 114'' - \frac{3e^2}{M^2} - \frac{3e^2}{N^2}$,

which is greater than $\frac{d}{D} \times 112'',5$ by $\frac{d}{D} \times 1''\frac{1}{2} - \frac{3e^2}{M^2} - \frac{3e^2}{N^2}$.

This Correction, therefore, must be applied to the Number taken out of the last Column of Table II. This may be resolved into two Parts, $\frac{d}{D} \times 1''\frac{1}{2} - \frac{3e^2}{M^2}$ and $-\frac{d}{D} \times \frac{3e^2}{M^2}$.

The first Part is contained in the second supplemental Table, the other Part in the first supplemental Table: Only when the greater Altitude is under 10° , the Correction $-\frac{d}{D} \times \frac{3e^2}{M^2}$ being not quite exact, the Correction in that

Case

Cafe was found from the Formula $-\frac{d}{D} \times 57'' - \frac{M\mu}{m}$; for it is plain, that this Quantity added to $\frac{d}{D} \times \frac{N\mu}{n} + 57''$, the Quantity standing in the last Column of Table II. makes $\frac{d}{D} \times \frac{N\mu}{n} + \frac{M\mu}{m}$ the second Part of the general Formula.

It has been shewn above, that when both Altitudes are considerable the Effect of Refraction $= 2et + \frac{e}{D} \times \frac{M^2 - N^2}{MN}$, the principal Part $2et$ being contained in Table III. the other Part serves as a Correction to it; the third supplemental Table contains the Values of $e \times \frac{M^2 - N^2}{MN}$, and the fourth supplemental Table serves to multiply this last Quantity by $\frac{1}{D}$, or the Cofecant of the Distance, in order to obtain the required Correction of Table III. of Refraction.

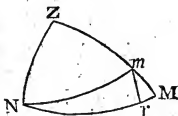
Investigation of the two Rules for finding the Effect of PARALLAX.

Let h = horizontal Parallax; then $Mm = hm$, and $Mr = Mm \times \text{Cof. } M$
 $= hm \times \frac{N - dM}{Dm} = \frac{Nh}{D}$
 $-\frac{hdM}{D} = \text{horizontal Pa-}$

rallax \times Sine of the Star's Altitude \times Cofec. Dist.
 $= \text{horizontal Parallax} \times \text{Sine of the Moon's Alt.} \times \text{Cotang. Distance.}$

The Effect of the Sun's Parallax might be found in the same Manner; but being very small, is conveniently thrown into two short Tables, the Vth and VIth supplemental ones.

Table IV. for Parallax contains the Product of the Versines of the Number of Minutes contained in the first Column, and the Cotangent of the Numbers at the Top of the Table, reduced into Seconds.



The

The Difference of the two Numbers taken out of this Table expresses the Quantity of the second Correction of Parallax, delivered in the Preface to the British Mariner's Guide; for the Investigation of which, see Philosophical Transactions, Vol. LIV. p. 273. for the Year 1764.

N. B. Table IV. will be found useful, as a general Table, for many other Purposes, where the Fluxions of spherical Triangles are concerned; of which take one

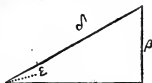
EXAMPLE.

Let it be required to find the Deviation of a Star's Parallel of Declination from the fixed horizontal Wire of a Quadrant placed in the Meridian, at any small given Distance of the Star from the Meridian. Enter the Table with the Star's Distance from the nearest Pole of the Equator at Top, and the given Distance from the Meridian, expressed in Minutes of a great Circle on the Side (in the Column marked Parallax) and you will find the Deviation required. Suppose the Distance of the Star from the Pole to be 10° , and the Distance from the Meridian to be $30'$ of an Arch of a great Circle, the Deviation will be found $45''$.

PROBLEM.

Having given the Hypotenuse δ , and one Leg β , of a right-angled spherical Triangle, to find the Angle opposite to this Leg.

Let ϵ be the Angle of a right-angled rectilinear Triangle, whose Hypotenuse is δ , and one Side β , and in Table IV. find what Number of Seconds answers to β in the Column of Parallax, and ϵ among the Distances; $\frac{1}{2}$ of this Number added to the Angle ϵ in the rectilinear Triangle, will give the spherical Angle.



EXAMPLE.

Let $\beta = 1^{\circ}$, $\delta = 2^{\circ}$, and therefore $\epsilon = 30^{\circ}$; the Number in Table IV. answering to $60'$ and 30° is $54''$, $\frac{1}{2}$ of which is $18''$; whence the spherical Angle $= 30^{\circ} 0' 18''$.

[This was communicated by Mr. LYONS.]

CORRECTION

C O R R E C T I O N

T O B E A P P L I E D T O T H E

E F F E C T O F R E F R A C T I O N

Found by the above or any other Method,

On account of the Barometer and Thermometer.

THE Refractions in Altitude, and consequently the Effect of Refraction upon the Moon's Distance from a Star, varying with the Changes of the Temperature of the Air, indicated by the Barometer and Thermometer, it becomes necessary to pay a Regard to this Circumstance, when the utmost Accuracy is required, and therefore as often as the supplemental Tables are made use of.

The Table of Refractions in Altitude, p. 2. was adapted by Dr. Bradley to the Altitude 50° of Fahrenheit's Thermometer, and the Altitude 29,6 Inches of the Barometer; and it will answer equally to the Altitude 55 of the Thermometer, and 30 Inches of the Barometer, which is about its mean Altitude at the Level of the Sea.

When they are at any other Heights, to find what Correction must be made to the Effect of Refraction, already found by Tables I. and II. or Table III. with the supplemental Tables; say, As 400 is to the Difference of the Thermometer from 55° ; so is the Effect of Refraction, before found, to its Correction required; to be subtracted from thence, if the Thermometer is higher than 55° ; but to be added, if the Thermometer is lower.

Take the Difference between the Altitude of the Barometer and 30 Inches, and say, As 300 is to the said Difference, expressed in Tenths of an Inch; so is the Effect of Refraction corrected for the Thermometer, to the Correction required on account of the Barometer; which added to or subtracted from the Effect of Refraction corrected for the Thermometer, ac-

G

according

ording as the Barometer is higher or lower than 30 Inches, gives the true Effect of Refraction corrected on account of both.

The common Barometer not being proper to be used at Sea, and the Changes of Refraction relative to this Instrument being generally much less than those answering to the Changes of the Thermometer, especially near and between the Tropics, perhaps the Correction of the Effect of Refraction on account of the Barometer will generally be omitted, except the Instrument called the Marine Barometer shall be found, or be improved, to be of sufficient Exactness for Use at Sea.

The Thermometer made use of should be of Fahrenheit's Scale; and if not kept always in a shady Place in the open Air, should be brought out when wanted, and kept in the Air for at least five Minutes, when it will come to its proper Station, answerable to the Temperature of the Air.

The Refraction in Altitude, taken out of the Table, p. 2. may, in like Manner as above, be corrected on account of the Barometer and Thermometer; but this will be of no great Consequence for correcting Altitudes taken from the Horizon of the Sea, as they can seldom be taken so exact as the Distance of the Moon from the Sun or Stars may; and the Exactness of a Minute is more than sufficient for all the Purposes to which the Altitudes taken at Sea are at present applied in the Practice of Navigation. But should an Observer take Altitudes of the Sun or Stars at Land, for finding his Latitude or the Time of the Day, with a well-divided astronomical Quadrant, or with a good Hadley's Quadrant, by the Help of Reflexion from a Basin of Water or Quicksilver, defended from the Wind, in such Case it might be proper that he should first correct the Refractions taken out of Table p. 2. in the Manner above explained, before he applies them to the Reduction of his Observations.

I cannot conclude this Subject without first paying a Tribute of Justice due to the Memories of those great Astronomers, Dr. Halley and Dr. Bradley, in the following Remark; that as to the former, we owe the Hint of the Use that may be made of the Barometer and Thermometer in correcting astronomical Refractions; so to the latter we owe the first Example of putting this Method in Practice, together with a more accurate Table of mean Refractions than was known before (see p. 2.) and a most excellent Rule expressing the Changes of the same Refractions, answering to the Variations of the Thermometer (the Substance of which is given above) deduced from the Mean of a great many Observations, made with an Instrument far superior to any before used in the Practice of Astronomy.

A NEW
METHOD
OF COMPUTING THE EFFECT OF
REFRACTION
AND
PARALLAX
UPON THE
MOON'S DISTANCE
FROM THE
SUN OR A FIXED STAR.

BY MR. DUNTHORNE.

A TABLE for reducing the apparent to the true Altitude of the Moon. I.

Hör. Par. D	53.	54	55	56	57.
Alt. D	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +
°	' "	' "	' "	' "	' "
0	20. 0	21. 0	22. 0	23. 0	24. 0
1	28. 31	29. 31	30. 31	31. 31	32. 31
2	34. 23	35. 23	36. 23	37. 23	38. 23
3	38. 20	39. 20	40. 20	41. 20	42. 20
4	41. 1	42. 1	43. 1	44. 1	45. 1
5	42. 54	43. 53	44. 53	45. 53	46. 53
6	44. 15	45. 14	46. 14	47. 14	48. 13
7	45. 16	46. 15	47. 15	48. 14	49. 14
8	46. 0	46. 59	47. 58	48. 58	49. 57
9	46. 32	47. 32	48. 31	49. 30	50. 29
10	46. 57	47. 56	48. 55	49. 54	50. 53
11	47. 15	48. 14	49. 13	50. 12	51. 11
12	47. 27	48. 26	49. 25	50. 23	51. 22
13	47. 35	48. 34	49. 32	50. 31	51. 29
14	47. 40	48. 38	49. 36	50. 35	51. 33
15	47. 42	48. 40	49. 38	50. 36	51. 34
16	47. 40	48. 38	49. 35	50. 33	51. 31
17	47. 36	48. 34	49. 31	50. 29	51. 26
18	47. 31	48. 28	49. 25	50. 22	51. 19
19	47. 23	48. 20	49. 16	50. 13	51. 10
20	47. 13	48. 9	49. 6	50. 2	50. 59
21	47. 2	47. 58	48. 54	49. 50	50. 46
22	46. 48	47. 44	48. 39	49. 35	50. 31
23	46. 33	47. 29	48. 24	49. 19	50. 14
24	46. 18	47. 12	48. 7	49. 2	49. 57
25	46. 0	46. 55	47. 49	48. 44	49. 38
26	45. 42	46. 36	47. 30	48. 24	49. 18
27	45. 22	46. 16	47. 9	48. 3	48. 56
28	45. 1	45. 54	46. 47	47. 40	48. 33
29	44. 39	45. 31	46. 24	47. 16	48. 9
30	44. 15	45. 7	45. 59	46. 51	47. 45

A TABLE for reducing the apparent to the true Altitude of the Moon. I. continued.

Hor. Par. D	58	59	60	61	62
Alt. D	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +
°	' "	' "	' "	' "	' "
0	25. 0	26. 0	27. 0	28. 0	29. 0
1	33. 31	34. 31	35. 31	36. 31	37. 31
2	39. 23	40. 23	41. 23	42. 23	43. 23
3	43. 20	44. 20	45. 19	46. 19	47. 19
4	46. 0	47. 0	48. 0	49. 0	50. 0
5	47. 52	48. 52	49. 52	50. 52	51. 52
6	49. 13	50. 13	51. 12	52. 12	53. 12
7	50. 14	51. 13	52. 13	53. 12	54. 12
8	50. 57	51. 56	52. 56	53. 55	54. 54
9	51. 29	52. 28	53. 27	54. 26	55. 26
10	51. 52	52. 51	53. 50	54. 50	55. 49
11	52. 9	53. 8	54. 7	55. 6	56. 5
12	52. 21	53. 19	54. 18	55. 17	56. 16
13	52. 28	53. 26	54. 25	55. 23	56. 22
14	52. 31	53. 29	54. 28	55. 26	56. 24
15	52. 31	53. 29	54. 27	55. 25	56. 23
16	52. 28	53. 26	54. 24	55. 21	56. 19
17	52. 23	53. 21	54. 18	55. 16	56. 13
18	52. 16	53. 13	54. 10	55. 7	56. 4
19	52. 6	53. 3	54. 0	54. 57	55. 53
20	51. 55	52. 51	53. 48	54. 44	55. 40
21	51. 42	52. 38	53. 34	54. 30	55. 26
22	51. 26	52. 22	53. 18	54. 13	55. 9
23	51. 10	52. 5	53. 0	53. 55	54. 51
24	50. 52	51. 47	52. 41	53. 36	54. 31
25	50. 32	51. 27	52. 21	53. 15	54. 10
26	50. 12	51. 5	51. 59	52. 53	53. 47
27	49. 49	50. 42	51. 36	52. 30	53. 23
28	49. 26	50. 19	51. 12	52. 5	52. 58
29	49. 1	49. 54	50. 46	51. 39	52. 31
30	48. 35	49. 27	50. 19	51. 11	52. 3

A TABLE for reducing the apparent to the true Altitude of the Moon. I. continued.

Hor. Par. D	/ 53	/ 54	/ 55	/ 56	/ 57
Alt. D	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +
°	/ "	/ "	/ "	/ "	/ "
30	44. 15	45. 7	45. 59	46. 51	47. 43
31	43. 51	44. 43	45. 34	46. 25	47. 17
32	43. 26	44. 16	45. 7	45. 58	46. 49
33	42. 59	43. 50	44. 40	45. 30	46. 21
34	42. 32	43. 22	44. 11	45. 1	45. 51
35	42. 3	42. 53	43. 42	44. 31	45. 20
36	41. 34	42. 23	43. 12	44. 0	44. 48
37	41. 4	41. 52	42. 40	43. 28	44. 16
38	40. 33	41. 20	42. 7	42. 55	43. 42
39	40. 1	40. 47	41. 34	42. 21	43. 7
40	39. 28	40. 14	41. 0	41. 46	42. 32
41	38. 54	39. 40	40. 25	41. 10	41. 56
42	38. 20	39. 4	39. 49	40. 34	41. 18
43	37. 44	38. 28	39. 12	39. 56	40. 40
44	37. 8	37. 52	38. 35	39. 18	40. 1
45	36. 32	37. 14	37. 56	38. 39	39. 21
46	35. 54	36. 35	37. 17.	37. 59	38. 41
47	35. 16	35. 56	36. 37.	37. 18	37. 59
48	34. 37	35. 17	35. 57.	36. 37	37. 17
49	33. 57	34. 36	35. 16.	35. 55	36. 34
50	33. 16	33. 55	34. 34.	35. 12	35. 51
51	32. 35	33. 13	33. 51	34. 29	35. 6
52	31. 54	32. 30	33. 7	33. 44	34. 21
53	31. 11	31. 47	32. 23	32. 59	33. 36
54	30. 28	31. 3	31. 39	32. 14	32. 49
55	29. 44	30. 19	30. 53	31. 28	32. 2
56	29. 0	29. 33	30. 7	30. 41	31. 14
57	28. 15	28. 48	29. 20	29. 53	30. 26
58	27. 30	28. 1	28. 33	29. 5	29. 37
59	26. 44	27. 14	27. 45	28. 16	28. 47
60	25. 57	26. 27	26. 57	27. 27	27. 57

A TABLE for reducing the apparent to the true Altitude of the Moon. I. continued.

Hor. Par. D	58	59	60	61	62
Alt. D	Cor ^a . +	Cor ^a . +	Cor ^a . +	Cor ^a . +	Cor ^a . +
0	1 11	1 11	1 11	1 11	1 11
30	48. 35	49. 27	50. 19	51. 11	52. 3
31	48. 8	49. 0	49. 51	50. 43	51. 34
32	47. 40	48. 31	49. 22	50. 13	51. 4
33	47. 11	48. 1	48. 52	49. 42	50. 32
34	46. 41	47. 30	48. 20	49. 10	50. 0
35	46. 9	46. 58	47. 47	48. 37	49. 26
36	45. 37	46. 25	47. 14	48. 2	48. 51
37	45. 3	45. 51	46. 39	47. 27	48. 15
38	44. 29	45. 16	46. 4	46. 51	47. 39
39	43. 54	44. 41	45. 27	46. 14	47. 1
40	43. 18	44. 4	44. 50	45. 36	46. 22
41	42. 41	43. 26	44. 11	44. 57	45. 42
42	42. 3	42. 47	43. 32	44. 17	45. 1
43	41. 24	42. 8	42. 52	43. 36	44. 19
44	40. 44	41. 27	42. 11	42. 54	43. 37
45	40. 4	40. 46	41. 29	42. 11	42. 53
46	39. 22	40. 4	40. 46	41. 27	42. 9
47	38. 40	39. 21	40. 2	40. 43	41. 24
48	37. 57	38. 37	39. 18	39. 58	40. 38
49	37. 14	37. 53	38. 32	39. 12	39. 51
50	36. 29	37. 8	37. 46	38. 25	39. 3
51	35. 44	36. 22	37. 0	37. 37	38. 15
52	34. 58	35. 35	36. 12	36. 49	37. 26
53	34. 12	34. 48	35. 24	36. 0	36. 36
54	33. 24	34. 0	34. 35	35. 10	35. 45
55	32. 36	33. 11	33. 45	34. 20	34. 54
56	31. 48	32. 21	32. 55	33. 28	34. 2
57	30. 58	31. 31	32. 4	32. 36	33. 9
58	30. 9	30. 40	31. 12	31. 44	32. 16
59	29. 18	29. 49	30. 20	30. 51	31. 22
60	28. 27	28. 57	29. 27	29. 57	30. 27

A TABLE for reducing the apparent to the true Altitude of the Moon. I. continued.

Hor. Par. D	' 53	' 54	' 55	' 56	' 57
Alt. D	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +
°	' "	' "	' "	' "	' "
60	25. 57	26. 27	26. 57	27. 27	27. 57
61	25. 10	25. 39	26. 8	26. 37	27. 6
62	24. 22	24. 51	25. 19	25. 47	26. 15
63	23. 35	24. 2	24. 29	24. 56	25. 23
64	22. 46	23. 12	23. 39	24. 5	24. 31
65	21. 57	22. 23	22. 48	23. 13	23. 39
66	21. 8	21. 32	21. 57	22. 21	22. 46
67	20. 18	20. 42	21. 5	21. 29	21. 52
68	19. 28	19. 51	20. 13	20. 36	20. 58
69	18. 38	18. 59	19. 21	19. 42	20. 4
70	17. 47	18. 7	18. 28	18. 49	19. 9
71	16. 56	17. 15	17. 35	17. 54	18. 14
72	16. 4	16. 23	16. 41	17. 0	17. 18
73	15. 12	15. 30	15. 47	16. 5	16. 23
74	14. 20	14. 37	14. 53	15. 10	15. 26
75	13. 28	13. 43	13. 59	14. 14	14. 30
76	12. 35	12. 50	13. 4	13. 19	13. 33
77	11. 42	11. 56	12. 9	12. 23	12. 36
78	10. 49	11. 2	11. 14	11. 27	11. 39
79	9. 55	10. 7	10. 19	10. 30	10. 42
80	9. 2	9. 13	9. 23	9. 33	9. 44
81	8. 8	8. 18	8. 27	8. 37	8. 46
82	7. 15	7. 23	7. 31	7. 40	7. 48
83	6. 21	6. 28	6. 35	6. 42	6. 50
84	5. 26	5. 33	5. 39	5. 45	5. 51
85	4. 32	4. 37	4. 43	4. 48	4. 53
86	3. 38	3. 42	3. 46	3. 50	3. 55
87	2. 43	2. 47	2. 50	2. 53	2. 56
88	1. 49	1. 51	1. 53	1. 55	1. 57
89	0. 54	0. 56	0. 57	0. 58	0. 59
90	0. 0	0. 0	0. 0	0. 0	0. 0

A TABLE for reducing the apparent to the true Altitude of the Moon. I. concluded.

Hor. Par. D	' 58	' 59	' 60	' 61	' 62
Alt. D	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +	Cor ⁿ . +
°	' "	' "	' "	' "	' "
60	28. 27	28. 57	29. 27	29. 57	30. 27
61	27. 35	28. 4	28. 34	29. 3	29. 32
62	26. 43	27. 11	27. 40	28. 8	28. 36
63	25. 51	26. 18	26. 45	27. 12	27. 40
64	24. 58	25. 24	25. 50	26. 17	26. 43
65	24. 4	24. 30	24. 55	25. 20	25. 46
66	23. 10	23. 34	23. 59	24. 23	24. 48
67	22. 16	22. 39	23. 2	23. 26	23. 49
68	21. 21	21. 43	22. 6	22. 28	22. 51
69	20. 25	20. 47	21. 8	21. 30	21. 51
70	19. 30	19. 50	20. 11	20. 31	20. 52
71	18. 33	18. 53	19. 12	19. 32	19. 52
72	17. 37	17. 55	18. 14	18. 33	18. 51
73	16. 40	16. 58	17. 15	17. 33	17. 50
74	15. 43	16. 0	16. 16	16. 33	16. 49
75	14. 46	15. 1	15. 17	15. 32	15. 48
76	13. 48	14. 2	14. 17	14. 31	14. 46
77	12. 50	13. 3	13. 17	13. 30	13. 44
78	11. 51	12. 4	12. 16	12. 29	12. 41
79	10. 53	11. 4	11. 16	11. 27	11. 39
80	9. 54	10. 5	10. 15	10. 25	10. 36
81	8. 55	9. 5	9. 14	9. 24	9. 33
82	7. 56	8. 5	8. 13	8. 21	8. 30
83	6. 57	7. 4	7. 12	7. 19	7. 26
84	5. 58	6. 4	6. 10	6. 17	6. 23
85	4. 58	5. 4	5. 9	5. 14	5. 19
86	3. 59	4. 3	4. 7	4. 11	4. 15
87	2. 59	3. 2	3. 5	3. 9	3. 12
88	1. 59	2. 2	2. 4	2. 6	2. 8
89	1. 0	1. 1	1. 2	1. 3	1. 4
90	0. 0	0. 0	0. 0	0. 0	0. 0

A TABLE of Logarithmic Differences for readily computing the true Distance of the Moon from a Fixed Star.
II.

Hor. Par. D	' 53	' 54	' 55	' 56	' 57
Alt. D	Log. Diff.	Log. Diff.	Log. Diff.	Log. Diff.	Log. Diff.
0					
0	+ 11.3	+ 11.2	+ 11.1	+ 11.0	+ 10.9
1	+ 4.2	+ 3.9	+ 3.6	+ 3.2	+ 2.9
2	- 5.3	- 5.9	- 6.5	- 7.1	- 7.6
3	16.1	16.9	17.7	18.5	19.3
4	27.3	28.4	29.4	30.5	31.5
5	38.8	40.1	41.3	42.6	43.9
6	50.4	51.9	53.4	54.9	56.3
7	62.0	63.7	65.5	67.2	68.9
8	73.6	75.6	77.5	79.4	81.4
9	85.2	87.4	89.5	91.7	93.8
10	96.8	99.1	101.5	103.9	106.3
11	108.3	110.9	113.5	116.1	118.7
12	119.7	122.6	125.4	128.2	131.0
13	131.2	134.2	137.2	140.3	143.3
14	142.6	145.8	149.0	152.3	155.6
15	154.0	157.4	160.9	164.3	167.8
16	165.2	168.9	172.5	176.2	179.9
17	176.4	180.3	184.2	188.1	192.0
18	187.6	191.7	195.8	199.9	204.0
19	198.7	203.1	207.3	211.6	216.0
20	209.8	214.2	218.8	223.3	227.8
21	220.8	225.5	230.2	234.9	239.6
22	231.6	236.5	241.4	246.3	251.3
23	242.3	247.5	252.6	257.8	262.9
24	253.2	258.4	263.8	269.1	274.5
25	263.7	269.3	274.8	280.4	285.9
26	274.3	280.1	285.8	291.6	297.3
27	284.8	290.8	296.7	302.7	308.5
28	295.2	301.3	307.4	313.6	319.7
29	305.5	311.7	318.1	324.4	330.8
30	315.6	322.1	328.7	335.2	341.7

A TABLE of Logarithmic Differences for readily computing the true Distance of the Moon from a Fixed Star:
II. continued.

Hor. Par. D	' 58	' 59	' 60	' 61	' 62
Alt. D	Log. Diff.	Log. Diff.	Log. Diff.	Log. Diff.	Log. Diff.
0					
0	+ 10.8	+ 10.8	+ 10.7	+ 10.6	+ 10.4
1	+ 2.5	+ 2.2	+ 1.8	+ 1.5	+ 1.1
2	— 8.2	— 8.8	— 9.4	— 10.0	— 10.6
3	20.1	21.0	21.8	22.6	23.5
4	32.5	33.6	34.7	35.7	36.8
5	45.1	46.4	47.7	49.0	50.3
6	57.8	59.4	60.8	62.4	63.9
7	70.6	72.3	74.1	75.8	77.6
8	83.3	85.3	87.2	89.2	91.1
9	96.0	98.2	100.3	102.5	104.7
10	108.6	111.0	113.4	115.9	118.2
11	121.3	123.9	125.5	129.1	131.7
12	133.8	136.6	139.5	142.3	145.2
13	146.4	149.4	152.4	155.5	158.5
14	158.8	162.0	165.4	168.6	171.9
15	171.2	174.7	178.2	181.7	185.2
16	183.5	187.1	191.0	194.5	198.3
17	195.8	199.8	203.7	207.6	211.5
18	208.1	212.2	216.3	220.4	224.6
19	220.2	224.6	228.9	233.3	237.6
20	232.3	236.8	241.4	245.9	250.4
21	244.4	249.1	253.8	258.6	263.3
22	256.2	261.2	266.1	271.0	276.0
23	268.1	273.2	278.3	283.5	288.6
24	279.8	285.2	290.5	295.8	301.2
25	291.4	297.0	302.5	308.1	313.7
26	303.1	308.7	314.5	320.2	326.0
27	314.4	320.4	326.3	332.3	338.3
28	325.8	332.0	338.1	344.3	350.4
29	337.0	343.4	349.7	356.1	362.4
30	348.2	354.7	361.3	367.8	374.3

A TABLE of Logarithmic Differences for readily computing the true Distance of the Moon from a Fixed Star.
II. continued.

Hor. Part. D	53	54	55	56	57
Alt. D	Log. Diff.	Log. Diff.	Log. Diff.	Log. Diff.	Log. Diff.
30	315.6	322.1	328.7	335.2	341.7
31	325.7	332.4	339.1	345.8	352.5
32	335.7	342.5	349.4	356.3	363.2
33	345.5	352.6	359.7	366.8	373.8
34	355.3	362.6	369.8	377.1	384.3
35	364.9	372.3	379.8	387.2	394.7
36	374.4	382.0	389.7	397.3	404.9
37	383.8	391.6	399.3	407.2	415.0
38	393.1	401.1	409.0	417.0	425.0
39	402.3	410.4	418.5	426.7	434.8
40	411.3	419.6	427.9	436.2	444.6
41	420.2	428.7	437.2	445.6	454.1
42	428.9	437.6	446.2	454.9	463.5
43	437.5	446.4	455.2	464.0	472.8
44	446.0	455.0	464.0	472.9	481.9
45	454.4	463.5	472.6	481.8	490.9
46	462.6	471.8	481.1	490.4	499.7
47	470.6	480.0	489.5	498.9	508.4
48	478.5	488.1	497.7	507.3	516.9
49	486.3	496.0	505.7	515.5	525.2
50	493.9	503.8	513.6	523.5	533.4
51	501.4	511.4	521.4	531.4	541.4
52	508.7	518.8	529.0	539.1	549.3
53	515.8	526.1	536.3	546.6	556.9
54	522.7	533.2	543.6	554.0	564.4
55	529.5	540.1	550.6	561.2	571.7
56	536.1	546.8	557.5	568.1	578.8
57	542.6	553.4	564.2	574.9	585.7
58	548.8	559.7	570.6	581.6	592.5
59	554.9	565.9	577.0	588.0	599.1
60	560.8	571.9	583.1	594.2	605.4

A TABLE of Logarithmic Differences for readily computing the true Distance of the Moon from a Fixed Star.
II. continued.

Hor. Par. D	' 58	' 59	' 60	' 61	' 62
Alt. D	Log. Diff.	Log. Diff.	Log. Diff.	Log. Diff.	Log. Diff.
30	348.2	354.7	361.3	367.8	374.3
31	359.2	366.0	372.7	379.4	386.1
32	370.1	377.1	383.9	390.9	397.8
33	380.9	388.0	395.1	402.2	409.3
34	391.6	398.9	406.1	413.4	420.7
35	402.1	409.6	417.0	424.5	432.0
36	412.5	420.2	427.8	435.5	443.1
37	422.9	430.6	438.5	446.3	454.1
38	433.0	441.0	449.0	457.0	465.0
39	443.0	451.2	459.3	467.5	475.7
40	452.9	461.2	469.5	477.9	486.2
41	462.7	471.1	479.6	488.1	496.7
42	472.2	480.9	489.5	498.2	506.9
43	481.6	490.5	499.3	508.1	517.0
44	490.9	499.9	508.9	517.9	525.9
45	500.0	509.2	518.3	527.5	536.6
46	509.0	518.3	527.6	536.9	546.2
47	517.8	527.3	536.7	546.2	555.6
48	526.5	536.1	545.7	555.3	564.9
49	535.0	544.7	554.5	564.2	574.0
50	543.3	553.2	563.1	573.0	582.9
51	551.4	561.5	571.5	581.5	591.6
52	559.4	569.6	579.8	589.9	600.1
53	567.2	577.6	587.8	598.1	608.5
54	574.8	585.3	595.7	606.1	616.6
55	582.3	592.8	603.4	614.0	624.5
56	589.5	600.2	610.9	621.6	632.3
57	596.6	607.4	618.2	629.0	639.8
58	603.4	614.3	625.2	636.2	647.1
59	610.1	621.1	632.1	643.2	654.2
60	616.5	627.7	638.8	650.0	661.2

A TABLE of Logarithmic Differences for readily computing the true Distance of the Moon from a Fixed Star.

II. continued.

Hor. Par. D	' 53	' 54	' 55	' 56	' 57
Ak. D	Log. Diff.	Log. Diff.	Log. Diff.	Log. Diff.	Log. Diff.
0					
60	560.8	571.9	583.1	594.2	605.4
61	566.5	577.8	589.0	600.3	611.5
62	572.1	583.5	594.8	606.2	617.5
63	577.6	589.0	600.4	611.9	623.4
64	582.8	594.3	605.9	617.4	629.0
65	587.9	599.5	611.0	622.8	634.4
66	592.7	604.4	616.2	627.9	639.7
67	597.3	609.2	621.0	632.8	644.7
68	601.8	613.8	625.7	637.6	649.5
69	606.1	618.2	630.2	642.2	654.2
70	610.2	622.3	634.4	646.5	658.5
71	614.2	626.3	638.5	650.6	662.7
72	617.8	630.1	642.4	654.5	666.7
73	621.1	633.7	645.9	658.2	670.5
74	624.7	637.0	649.4	661.7	674.2
75	627.9	640.3	652.7	665.1	677.5
76	630.9	643.3	655.7	668.2	680.6
77	633.6	646.0	658.5	671.1	683.6
78	636.0	648.6	661.2	673.7	686.3
79	638.3	650.9	663.5	676.1	688.7
80	640.5	653.1	665.7	678.3	691.0
81	642.3	654.9	667.7	680.4	693.1
82	644.0	656.7	669.4	682.2	694.9
83	645.5	658.2	671.0	683.8	696.5
84	646.9	659.5	672.3	685.2	697.9
85	647.9	660.7	673.5	686.4	699.1
86	648.8	661.6	674.5	687.3	700.1
87	649.5	662.3	675.2	688.0	700.9
88	650.1	662.9	676.0	688.5	701.5
89	650.3	663.2	676.2	688.9	701.8

A TABLE of Logarithmic Differences for readily computing the true Distance of the Moon from a Fixed Star.
II. concluded.

Hor. Par. D	' 58	' 59	' 60	' 61	' 61
Alt. D	Log. Diff.	Log. Diff.	Log. Diff.	Log. Diff.	Log. Diff.
0					
60	616.5	627.7	638.8	650.0	661.2
61	622.8	634.0	645.3	656.6	667.9
62	628.9	640.3	651.6	663.0	674.4
63	634.8	646.3	657.8	669.2	680.7
64	640.6	652.1	663.7	675.3	686.9
65	646.1	657.8	669.4	681.1	692.8
66	651.4	663.2	674.9	686.7	698.4
67	656.5	668.3	680.2	692.0	703.9
68	661.4	673.3	685.3	697.2	709.2
69	666.2	678.1	690.2	702.2	714.2
70	670.6	682.7	694.8	706.9	719.0
71	674.9	687.0	699.2	711.3	723.5
72	678.9	691.2	703.4	715.6	727.9
73	682.8	695.1	707.4	719.7	732.0
74	686.5	698.8	711.2	723.5	735.9
75	689.9	702.3	714.7	727.1	739.6
76	693.2	705.6	718.1	730.6	743.0
77	696.1	708.6	721.2	733.8	746.2
78	698.8	711.4	724.0	736.6	749.1
79	701.3	714.0	726.5	739.2	751.8
80	703.6	716.3	729.0	741.6	754.3
81	705.7	718.4	731.1	743.8	756.5
82	707.6	720.3	733.1	745.8	758.5
83	709.3	722.0	734.8	747.5	760.3
84	710.7	723.5	736.2	748.9	761.8
85	711.9	724.7	737.5	750.1	763.1
86	712.9	725.7	738.5	751.3	764.2
87	713.7	726.5	739.3	752.1	765.0
88	714.2	727.1	740.0	752.8	765.6
89	714.5	727.3	740.3	753.1	766.0

U S E

OF THE PRECEDING

T A B L E S.

P R O B L E M.

HAVING the apparent or observed Distance of the Moon from a Fixed Star, together with the observed Altitude of each, to find their true Distance.

S O L U T I O N.

With the Moon's horizontal Parallax, and apparent Altitude, take out the Correction of her Altitude from Table I. also the logarithmic Difference from Table II. which reserve; and to the Correction of the Moon's Altitude add the Refraction of the Star; this Sum added to or subtracted from the Difference of the observed Altitudes, according as the Moon is higher or lower than the Star, gives the Difference of their true Altitudes.

Then, from the Natural-cosine of the Difference of the apparent Altitudes subtract the Natural-cosine of the observed Distance, and find the Logarithm of the Remainder; from which take the logarithmic Difference before reserved, and you will have a Logarithm, whose corresponding Number subtracted from the Natural-cosine of the Difference of their true Altitudes leaves the Natural-cosine of the true Distance required.

E X A M P L E.

EXAMPLE.

(From Mr. MASKELYNE's Mariner's Guide, p. 17, &c.)

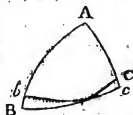
1762, May 9, at $12^h. 34'. 19''$ apparent Time at Greenwich,
according to Account at Sea,The apparent Distance of the Moon's Centre from }
Spica Virginis was } $51. 28. 35''$ The apparent Altitude of the Star $24. 48$ The apparent Altitude of the Moon's Centre $12. 30$ Difference of the apparent or observed Altitudes $12. 18$ Correction of the Moon's Altitude from }
Table I. } $50. 42''$ Refraction of the Star $2. 3$ Sum subtracted $52. 45$ Difference of their true Altitudes $11. 25. 15$ Natural-cosine of the Difference of apparent Al- }
titudes } 97705 Natural-cosine of $51^{\circ}. 28'. 35''$, the apparent Di- }
stance } 62283 Difference of the Natural-cosines 35422 Logarithm thereof 4.54927 Logarithmic Difference taken from Table II. sub- }
tract } 135 Remainder 4.54792 Number corresponding thereunto 35312 Natural-cosine of $11^{\circ}. 25'. 15''$, the Difference of }
their true Altitudes } 98920 From which subtract the above corresponding }
Number } 35312 Leaves Natural-cosine of $51^{\circ}. 9'. 54''$, the Moon's }
true Distance from the Star } 62708

Note: If only the first five Figures of the Sines and Logarithms be used, they will commonly determine the Moon's true Distance from a Star, within 5'', or at most 10''; in which Case, the last Figure of the logarithmic Differences is to be omitted, and if the Star's Altitude be above 5°, the remaining Figures will need no Correction: but if greater Exactness be desired, so that six Figures of the Sines and Logarithms be taken, all the Figures in the Table of logarithmic Differences are to be made use of; and if the Star's Altitude does not exceed 25°, are to be increased, as in the following Table.

Alt. of the Star.	Particles to be added to Log. Diff.	Alt. of the Star.	Particles to be added to Log. Diff.
0		10	0.4
2	4.4	11	0.3
3	2.7	12	0.3
4	1.8	13	0.2
5	1.3		
6	0.9	14	0.2
7	0.7	15	0.1
8	0.6	20	0.1
9	0.5	25	0.1

Investigation of the foregoing Solution.

In the spherical Triangle BAC, wherein A represents the Zenith, B the Moon, and C the Star, are given the three Sides, to find how much the Base BC is altered, by varying the Sides AB and AC, while the Angle at the Vertex A remains the same.



As Sine AB \times Sine AC : R² :: Ver. fine BC — Ver. fine AB — AC : Ver. fine A.

And, as Sine Ab \times Sine Ac : R² :: Ver. fine bc — Ver. fine Ab — Ac : Ver. fine A. Per Caswell Trigon. Axiom. 4.
Then